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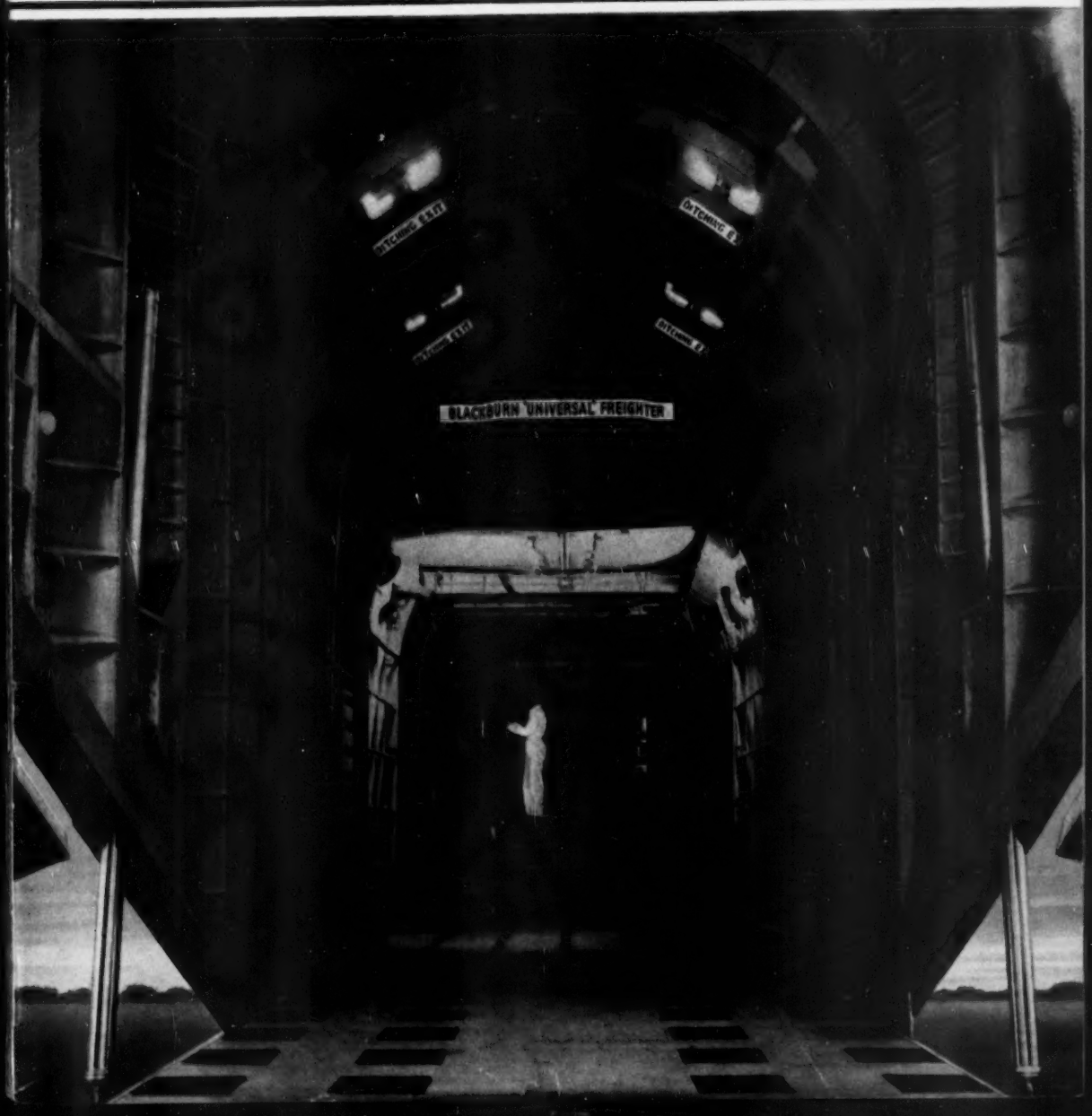

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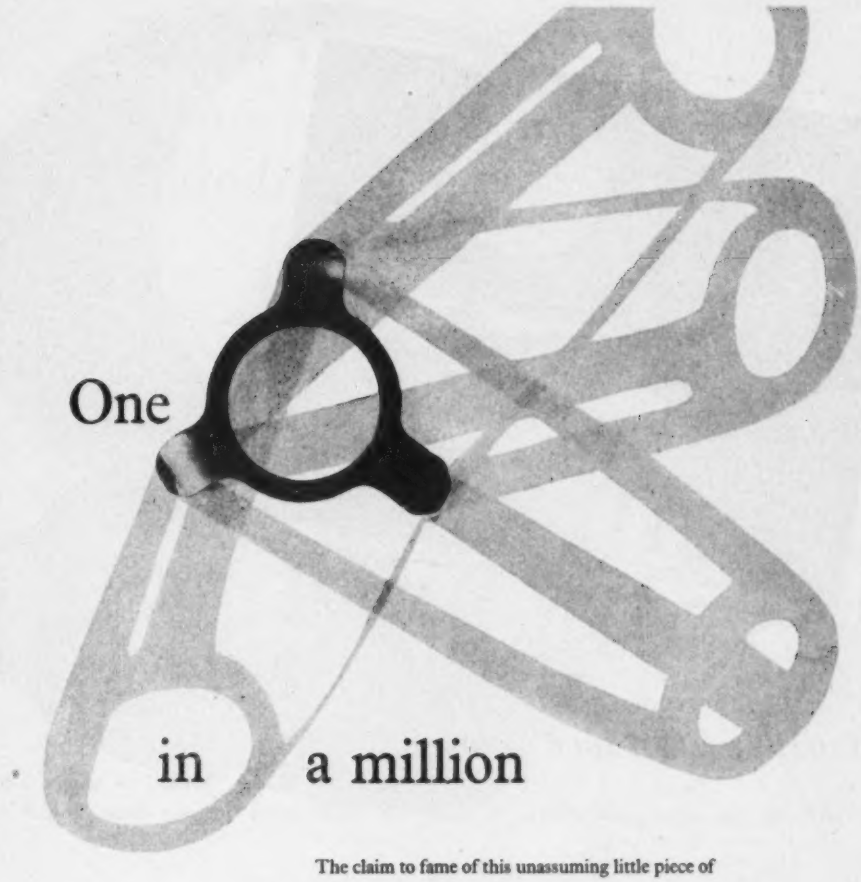

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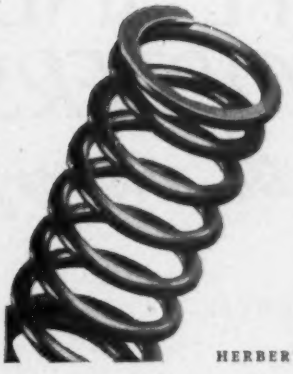

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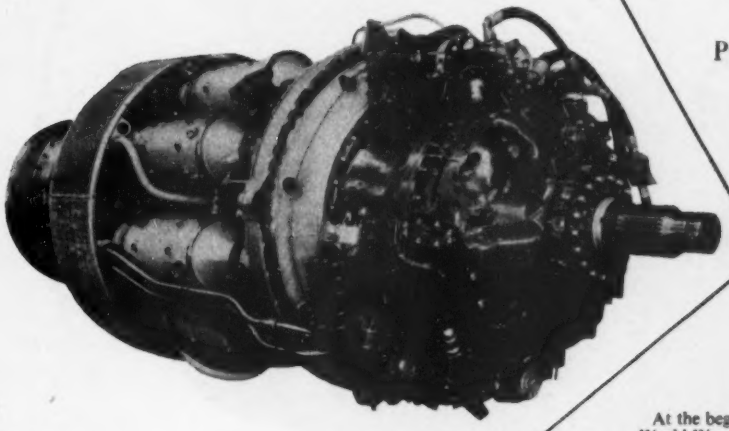

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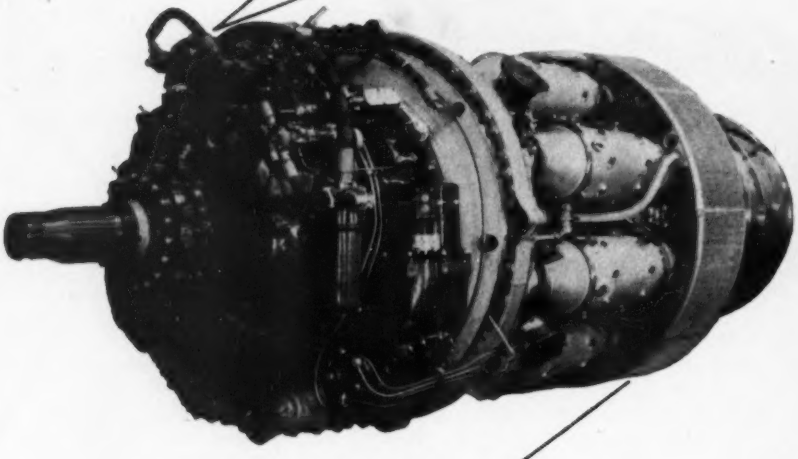

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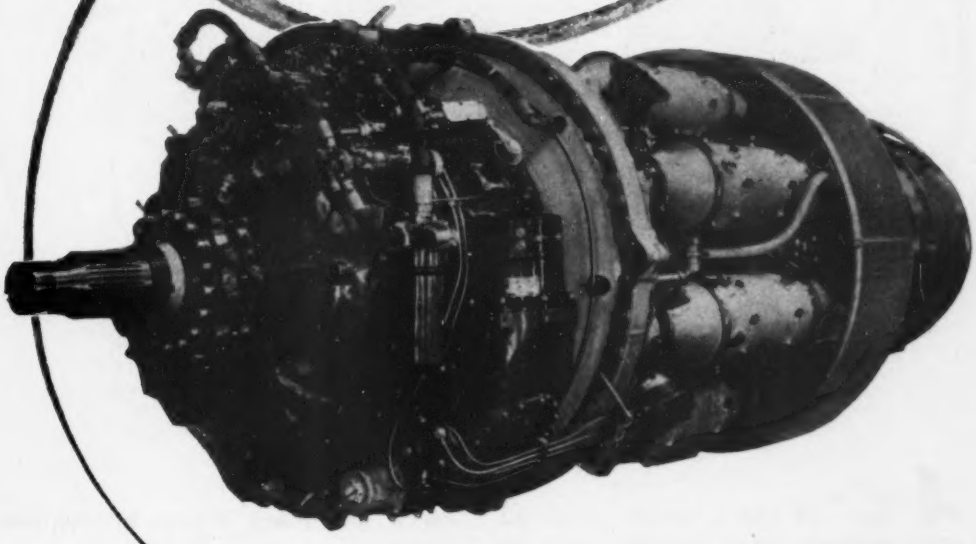

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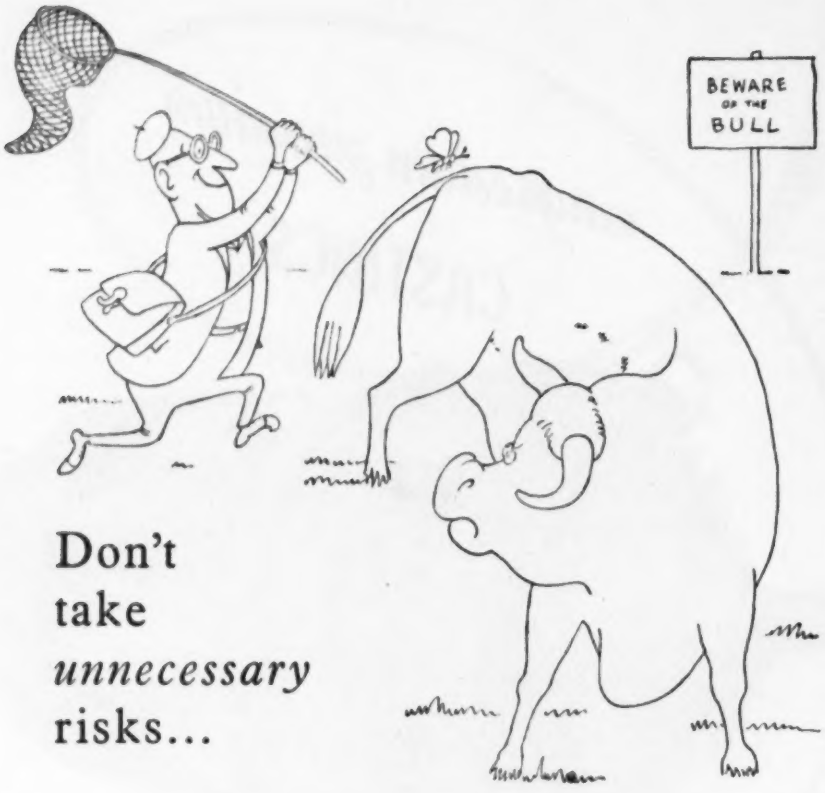

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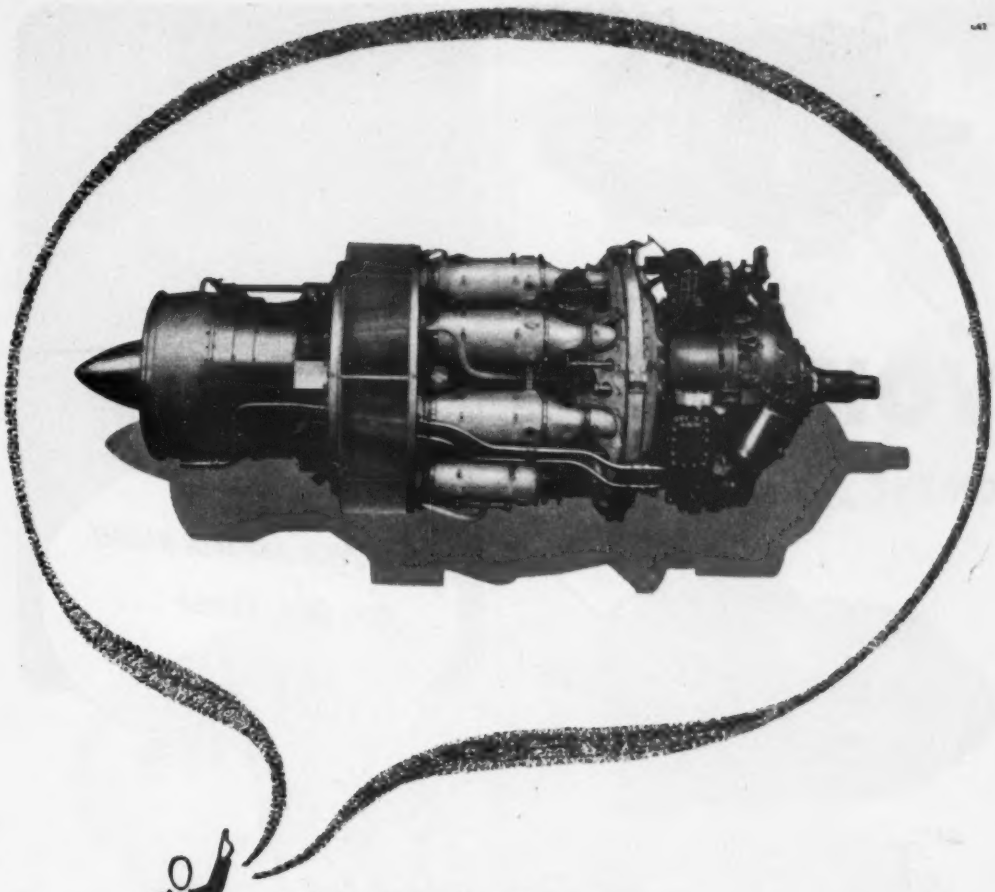

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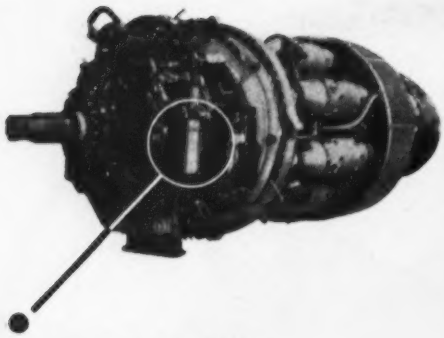

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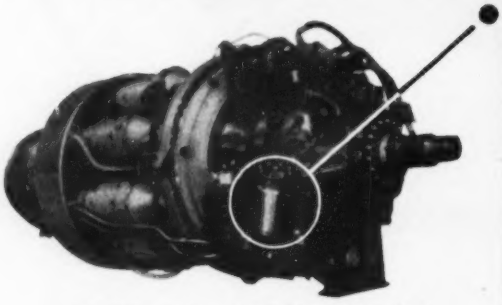

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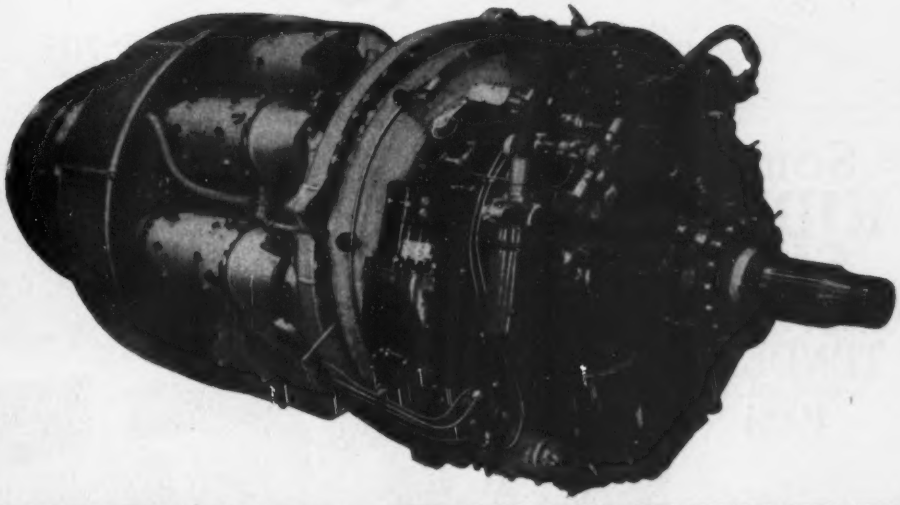

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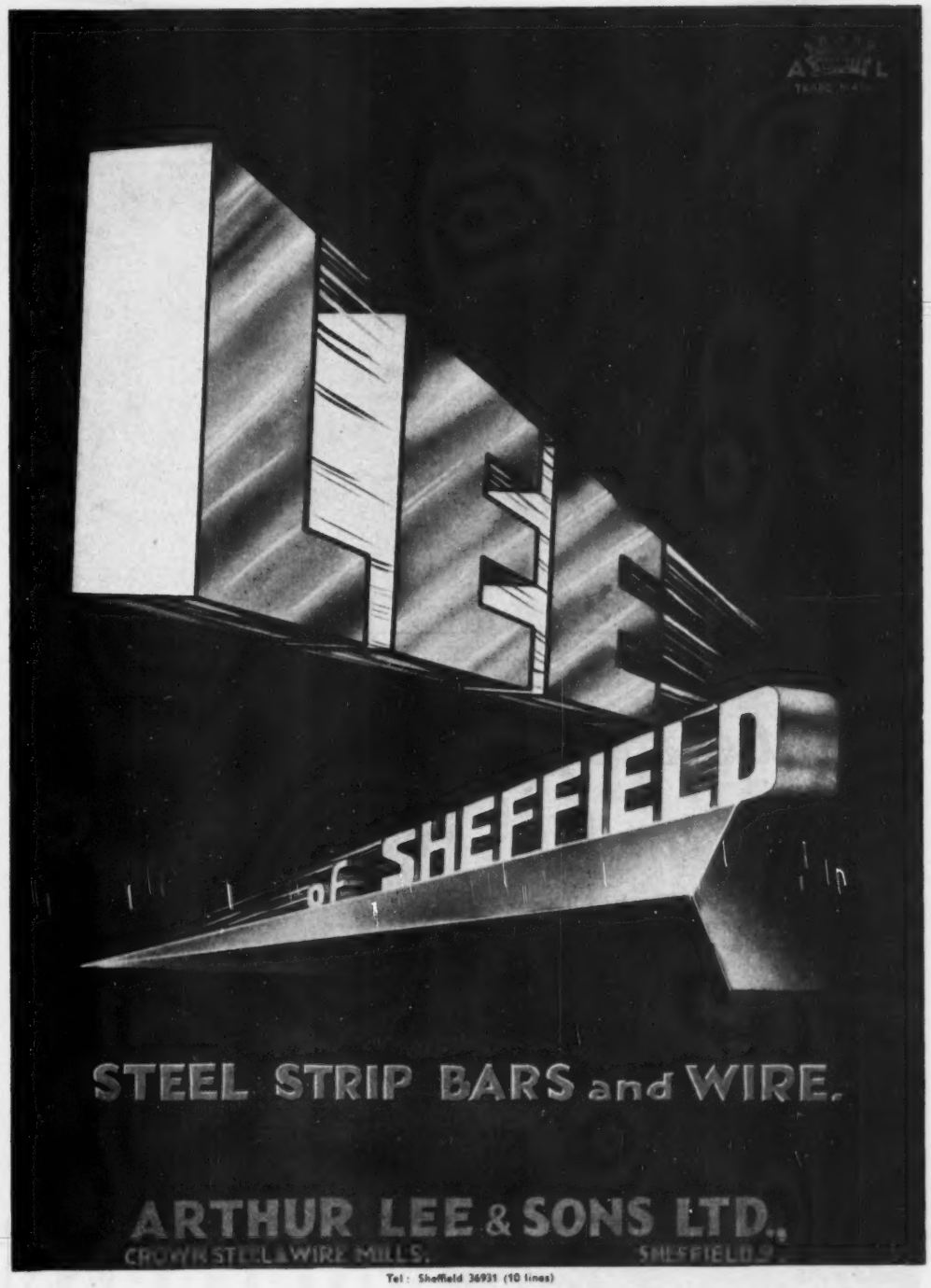
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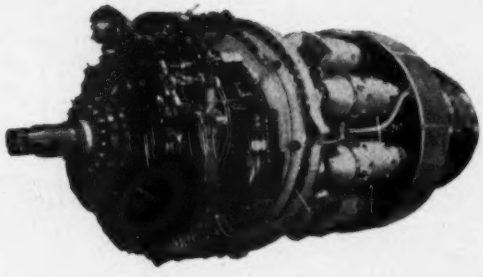

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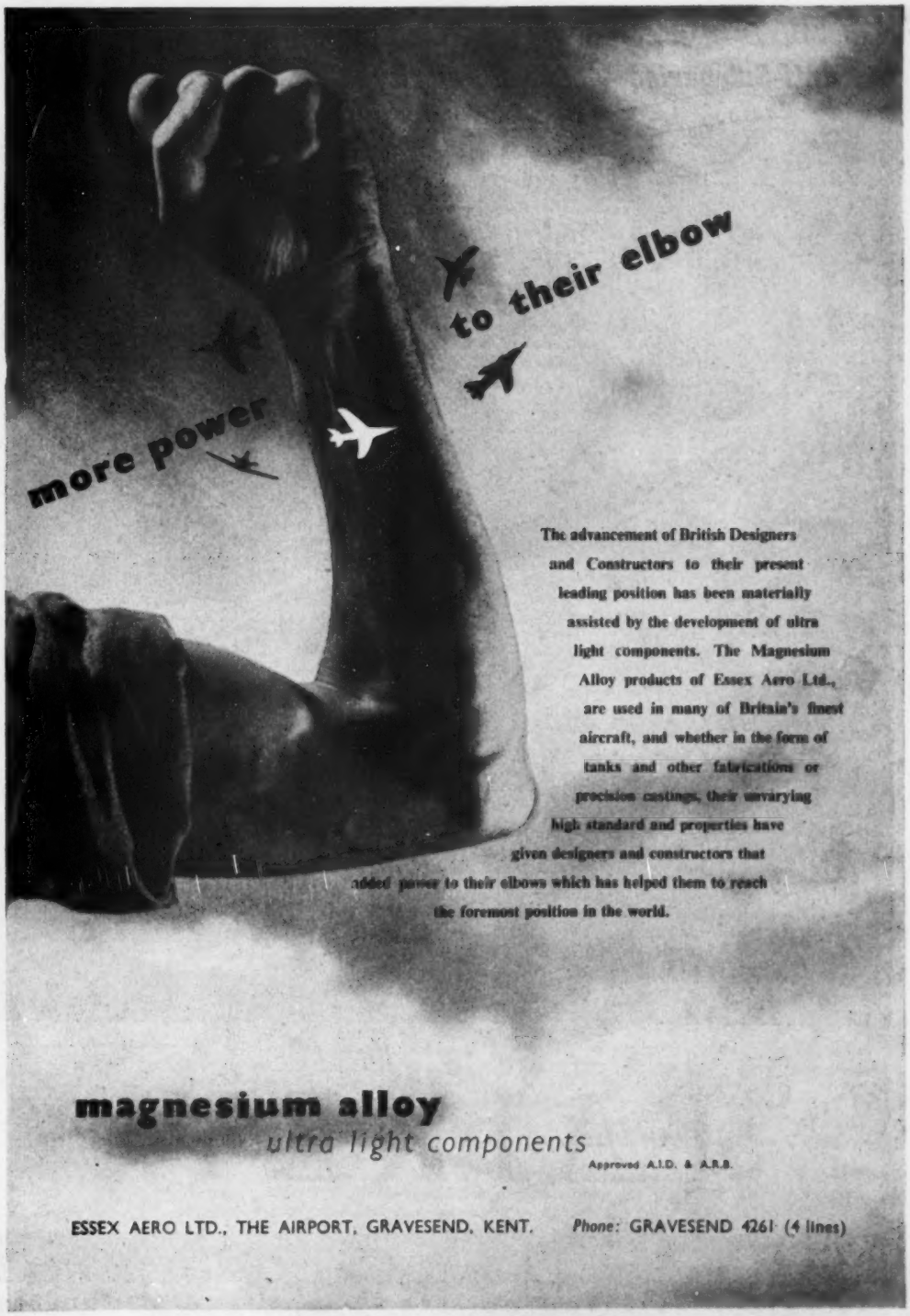

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Founded 1909

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Cold War of Independence

MANY difficulties faced the new Minister of Civil Aviation, Mr. A. T. Lennox-Boyd, and his predecessor, Mr. Maclay, in formulating the new air-transport policy announced on May 27th (page 696 of this issue). Despite severe criticism from both the Opposition and the protagonists of private enterprise, there seems no doubt that the Government has made a serious study of a very complex situation.

A preliminary examination of Mr. Lennox-Boyd's announcement discloses little justification for Opposition complaints that the future of the Corporations is jeopardized by the declared intention of encouraging private enterprise to the maximum consistent with the broad interests of the nation; and, not surprisingly, many independent operators claim that the Government has applied this principle insufficiently far. Before passing judgment it seems wise to examine some of the many considerations underlying the Minister's admittedly cautious decision—and also to await the outcome of negotiations still in progress.

The terms of the new policy admit no disruption of the major overseas scheduled services flown by the Corporations. Our State airlines are operating with growing efficiency and maintaining British prestige at a high level in the face of strong foreign competition, and no purpose would be served by encouraging direct competition from other British airlines. The Government's intention is to improve the prospects of the independents at no extra cost to the taxpayer, whereas the re-equipping of private fleets with the expensive new aircraft required for regular passenger operations on trunk routes would almost certainly involve payment of subsidies large enough to justify even further State control of airline operations. To subsidize one or more State-controlled lines at the expense of another would clearly be unpractical; in any case, the private companies would be unwilling to sacrifice their independence.

Long-range freight services are another matter, for suitable ex-B.O.A.C. aircraft are, or soon will be, available; the Corporations have not so far exploited the full possibilities of overseas freight operation, which may now provide the independents with some of their best openings for expansion. The new policy also offers them freedom to develop a number of overseas and domestic passenger routes (though the internal services are still being discussed) and, to ensure that companies can operate on a reasonably secure basis, licences will be granted for periods of at least seven years.

Perpetuity

The policy is intended to permit a definite but gradual expansion of independent activities. The Minister has evidently felt unable, at least for the time being, to encourage hopes of sudden and spectacular growth. He has attempted to take into account the possibility of a change of Government, for if the policy itself does not survive, the long-term security which it promises to the independents cannot be fulfilled.

Nevertheless, his caution has been strongly criticized by the British Independent Air Transport Association, representing the interests of 17 private companies in dealings with Government departments. One B.I.A.T.A. comment meriting special attention is that the future of its members, and of other independent airlines, is more than a departmental matter involving the Ministry of Civil Aviation—that the survival of this potential military-transport force is also of direct concern to the Air Ministry and War Office. Mr. Lennox-Boyd is likely to be influenced by military considerations when fulfilling his promise that, having cleared away legal obstacles, he will examine ways of easing the practical difficulties facing the independents.

Re-equipment with new aircraft is not the least of these problems; if the private companies acquired a more definite relationship with the R.A.F. than they possess at present their usefulness would be broadened and their prospects improved without prejudice to their non-subsidized status. Such an arrangement, if it proved possible (the State-owned, civil-operated Auxiliary Transport and V.R. aircraft are examples of satisfactory "combined operation"), would offer two-way security—to the nation, whose military air-transport forces are well below strength, and to the merchant airlines themselves.

Our American Correspondent Reports on—

U.S. REACTIONS to the COMET

Generous Press Treatment: Industry's Anxiety to Catch Up

ONLY five weeks have elapsed since the Comet entered B.O.A.C. service; but even in that brief period the type has made more history. The happy circumstances of a flight by the Queen Mother and Princess Margaret were recorded in our issue of May 30th, and this week we report that the London-Johannesburg services were increased, from June 1st, to three a week in each direction. Evidently the American Press, whose tributes to the Comet are instanced here, are in no danger of running short of copy.

THERE have been some tiresome characters who have spent a lot of time during the last five years saying that there was no such thing as a Comet and that, if there was, it wasn't going to be visible to the naked eye. One's urge to say "I told you so" being deep-seated and powerful, it was all the more satisfactory to find that the American newspaper coverage and general reaction to the first operational flights of our turbine transport were adequate and appreciative.

Most of the daily and technical Press gave the Comet flights good coverage and ran stories either by their own correspondents or from the agencies. The Editor of *Flight*, as a guest writer, had an excellent short piece in *Aviation Week*. A number of papers saw fit to underline the news with editorials; these were nearly all of the "Milestone in Aviation History" variety, with due credit being given to de Havillands, B.O.A.C., and the British aircraft industry.

For those turbine-transport and Comet supporters here in the U.S.A.—both British and American—who have lived through five years of "It won't work," or "You can't pressurize it," or "What happens when a turbine wheel lets go or a window blows out?" or "Say, you'll never be able to put it into the traffic pattern," and, finally, "Never be an economic proposition," it was comforting to read such newspaper comments as: "This flight by the de Havilland Comet is jolting U.S. airlines into the realization that sooner or later they will have to acquire jet transports" . . . "The American airlines have been caught napping" . . . "Our domination [of the air transport field] is seriously threatened by the British" . . . "Today's flight is just the beginning of Britain's effort to snatch customers away."

Whichever way the pendulum of opinion may swing in the future, there is today a clear appreciation in technical circles as to what has happened. But, in order to soften the blow generally, operators, manufacturers and the Press are all placing greater and greater accent on the economic attributes of the current American civil transports, and less on future turbine development. And, of course, the soundness of this "economic development" policy should not be underestimated, particularly with overheads rising fast. For the time being the domestic operators will say they are content, and will convince people that they are.

But to many it must seem strange that the big and vital aircraft industry of the United States is lagging behind in the important area of turbine-transport development. Hindsight is not always as easy as it looks, and although it is possible to list some of the more obvious reasons for today's situation, the more obvious answers don't explain everything. The first question is why, when the Americans realized the extent of British progress, nothing practical was done about it. Perhaps nobody can take the blame. It was due as much as anything else to a national state of mind.

In the main, the roots of the trouble were complacency, a lack of adequate long-term planning, and too slow an appreciation of what the British turbine programme really meant. There was disbelief that Britain could pull such rapid construction and development out of its war-torn bag, and a strong feeling that, once jet transports were really needed, the American industry could and would supply them almost overnight. Also, at that time (and probably until very recently) the manufacturers hadn't the finance—or perhaps the financial courage—to take a chance on building something which might run them into a great deal of money. The costs associated with the grounding of the Constellation and DC-6 were still too fresh in everyone's mind.

This natural reluctance to commit themselves before it was necessary received some support from overseas, too. Almost exactly five years ago, *Flight* quoted an American official, based in London, who averred that there was no chance of the British producing in the near future any jet transport capable of being used on a regular service. Nearer home, the same train of thought was noticeable in the discussions at the meeting of the S.A.E. Aviation Section in Los Angeles in 1948. With the exception of one West Coast manufacturer and a few lone voices, there was a general tendency to dismiss the turboprop altogether and to assume that the production of a pure-jet transport was still a long way off. Airscrew troubles on the airlines at that time, and lack of suitable American gas turbines, were contributory causes to such thinking. It was not, in fact, until the S.B.A.C. Show of 1949 that the impact of British progress was first felt. But then came the Korean war, and the manufacturers went back to military production, where orders come from, and are paid for, by the Government, and without the costs and uncertainties associated with the civil market.

From 1949 onwards, certainly, attempts were made in Congress to urge things forward by suggesting Govern-

As British as our hedges, stacks and stiles; as new as they are old—the de Havilland Comet.

mental assistance, generally in the form of financial aid to the manufacturers, and several members sponsored Bills to this end. The most popular of these was the "Prototype Aircraft Bill," but some of the manufacturers gave it a cool reception, apparently because they thought it might be a first step towards control or even nationalization of their industry. Finally a watered-down version of the Bill was passed, but it only covered the testing of machines once built and the operation of jet aircraft on simulated civil airline schedules in order to get practical experience of operations. Even the actual voting of the money for this latter purpose has bogged down in an economy-minded Congress.

During 1950 news of the Comet and Viscount and Apollo —and later of the Britannia and Dart-Dakotas—was trickling in across the Atlantic. It was received with mixed emotions and varied comment, and even disbelief as to a successful outcome. Naturally, reactions changed as time went by, but there were still a great many people who thought that even if we were fortunate enough to get through our test and development stage without trouble, actual passenger operation would be prohibited by technical and navigational and physical difficulties.

All this, of course, is an over-simplification of a most complex reaction; but there is no doubt that a number of people who should have known better did much to contribute to all this confusion of thought. (Some of what was said was perfectly understandable; if the shoe had been on the other foot we British should have been the first to excuse our position, as we did with such vehemence about airliner shortage between 1945 and 1949.)

Nevertheless, underneath America's apparent indifference there is today a strong current of endeavour. As this article is written, four Bills, the most promising of which is S.2344, introduced by Senator McCarran, are being discussed before the Senate Interstate and Foreign Commerce Committee. All call for Government financing in some form or another. Senator McCarran's idea is to subsidize those American airline operators who buy new American jet equipment in preference to "foreign-built" types. In effect, S.2344 introduces a "construction differential," and aims to reimburse the purchaser with the difference between what he paid the American manufacturer and the (presumably lower) cost of an equivalent aircraft available from some other nation. The basis of this Bill is, of course, the well-worn argument that other governments subsidize their aircraft and airlines and that their manufacturing costs are lower—all to the detriment of the American manufacturer and operator. But if this Bill goes through, the Government will be faced with a situation in which it is endeavouring to cut down on heavy mail-pay subsidies to the airliners on one hand while granting them construction differentials on the other. Also, the method of assessing foreign manufacturing costs and prices seems to be something which could be fraught with interest.

But apart from any question of official assistance both pride and public pressure are, in any case, driving the industry towards some immediate action. The interested Government agencies, the Air Transport Association of America, and the manufacturers have all been working hard on drawing up a suitable jet-transport specification. (Although important, the turboprop-airliner situation is secondary, for it is assumed that this gap will be filled by re-engined piston transports or descendants thereof, just as soon as the Pratt and Whitney T-34 and Allison T-38 engines are available and the manufacturers have satisfied their Air Force and Navy contracts for such an aircraft.)

The A.T.A.—which is a very forceful and active body and which generally manages to steer a pretty accurate course between the often conflicting desires of its members, the Government and the manufacturers—has been discussing specifications with the airlines, and the latest meeting at Chicago a few weeks ago is expected to produce results. Tied in with this is the belief that two or three of the West Coast firms have started to build a prototype. Of these, Lockheed and Douglas are probably as far ahead as anyone, the former thinking in terms of a big non-stop Atlantic aircraft, while Douglas are said to be looking more towards the domestic market, with something not quite so advanced. Once these firms get going, they must and will move fast, so that the end of 1954 might see an all-American pure-jet transport actually wheeled out of the hangar. Provided, of course, suitable engines are available.

"H.P." on MILITARY TRANSPORT POLICY

THE chairman of the Handley Page organization can usually be relied upon for either (*a*) amusing, or (*b*) plain, speaking. In his review of the company's year, circulated to shareholders last week, he chose the second alternative, and current British military-transport policy was his target.

Saying that disappointment had been caused on all sides by a policy which denied expansion to Transport Command, Sir Frederick Handley Page continued: "While it is laudable that the British aircraft industry's efforts should be concentrated on fighters and bombers, nevertheless it is vital that Britain should have an adequate number of fast military transports. They not only ensure that whole brigades of troops can be moved around the world in a matter of hours but also, because of this impressive mobility, are the means for economy in soldier-power.

"Transport Command's extreme value has been demonstrated in each of the recurrent political and military crises engendered by the 'cold war.' Re-equipment with modern jet transports would increase its power greatly.

"At the same time, because of this basis of military development and construction, maintenance of the present British lead in commercial jet transport would be encouraged.

"There is a tendency for Britain to concentrate its main effort on military aircraft production, but for the United States to include transports also. The experience so gained by the U.S. in the last war caused that country's airliners to become pre-eminent on the world's air routes from the end of the war until lately, when Britain's new commercial aircraft, developed from scratch since 1946, have gone into service.

"One must not overlook the great contribution which the export of civil aircraft from this country can make in assisting its national economy and one must not leave out of account the technical contribution made to civil aircraft by the design and production of military transports.

"A suggestion, sometimes heard, is that Britain should build fighters exclusively and leave the United States to produce not only the transports but also the long-range bombers for our national air force. Such a policy would be catastrophic. We cannot allow an ally, no matter how closely linked we may be, to provide the force which in wartime is vital to our existence. Ultimately, it is the bomber which defends a nation by giving long-range superiority of air power and is the greatest deterrent to the possibility of enemy armed-aggression."

Sir Frederick's review then went on to point out that concentration solely on fighter production would lead to a loss of "know-how" in the building of big aircraft.

In an earlier section, he deplored the "ever-lengthening period" which elapses between the issue of military-aircraft specifications and the introduction of the machines into service. Pre-production orders should, he maintained, be placed at an early design-stage in order that a useful service life might be obtained and a rapid rate (and high cost) of obsolescence avoided.

The financial section of the chairman's review reported a group net profit of £180,410, after provision of £372,920 for taxation, representing an increase of £7,131 over the previous year's figure.

AVRO EYE-OPENERS

PROMISE of a new Avro bomber—which has long been discussed in aeronautical circles—was reported last week following the "Last Anson" ceremony (see page 685) at Woodford. The disclosure was attributed to Sir Roy Dobson, the company's managing director, who (though later he said that he must have been misquoted) was reported as saying, "I hope we shall have another bomber before long. I hope we shall be able to show you something in September that will open the eyes of the people who don't know."

Sir Roy certainly made reference to another Avro development, one which came as a surprise to many people: the firm is now building two delta-wing trainers for the R.A.F.—"in order," as Sir Roy said, "to get people used to the idea of flying things of an entirely different shape."

FROM ALL QUARTERS

Experts Round the B.B.C. Table

THE B.B.C.'s "Taking Stock" discussion on Thursday evening of last week struck us as being one of the most successful of the series. It was devoted to a topical aircraft-production problem, military *v.* civil output, and the four experts were (unlike some experts in other fields) admirable broadcasters; and chairman Charles Gardner preserved the balance delicately.

Lord Pakenham was doubtful whether the British aircraft industry was doing all it could to cash in on the civil market; it was naturally reluctant to stake capital beyond its order-book, so might not the Government underwrite courageous efforts to capture world markets? And how about a Cabinet-level "pep" committee to free both civil and military production of red tape and to secure action in such matters as housing for aircraft workers?

His suggestion that our present leadership in civil jet development was but a "fleeting opportunity" was challenged by *Air Chief Marshal Sir Alec Coryton* (Bristols) and *Mr. George Edwards* (Vickers-Armstrongs): they felt that even the U.S. industry could not work miracles—"Ten hens sitting on one egg," said Mr. Edwards, "don't cut down the time needed to hatch the chick."

Reverting to the main argument, military *v.* civil, Mr. Edwards said that Vickers were attacking the problem by extensively subcontracting the Valiant and assembling it in the main works, while concentrating Viscount production (54 are on order) in a factory elsewhere. They were confident of being able to put out four, or even six, Viscounts a month by 1954.

A. Cdre. A. V. Harvey, M.P. (lately appointed Handley Page deputy chairman) warned against too much optimism about production capacity: the demand for British jet airliners might soon rise enormously.

Sir Alec Coryton took a more conservative view, saying that the risk was unlikely to come until the aircraft—he instanced the Britannia, yet to fly—had proved themselves in service. Then there would be a large demand which might be difficult to meet. His answer (Mr. Edwards and A. Cdre. Harvey concurring) was that the industry must expand geographically.

There was fairly general agreement that guaranteed stability of employment in the industry was a "must"; that over such matters as housing workers some local authorities were playing the game and some were not; and that there was at present too much frittering of effort on "unproductive" types of aircraft.

There was support, too, for Sir Alec Coryton's observation that a big factor in our jet-airliner progress would be the jet's advantage over the piston-engined aircraft in operational economy (other speakers had referred to America's well-entrenched position on the world market for piston types).

Lord Pakenham mentioned the existence of a Government plan (which is apparently progressing only slowly) for building 11,000 houses for aircraft workers, with, if necessary, a subsidy of £200 per house.

Though much of the argument was familiar—we recognized quotations from recent articles in this journal—the discussion was, altogether, a stimulating one.

From The Bastille?

THE following—evidently a real piece of inside information—is quoted from our contemporary *Aviation Week* for May 26th: "In Paris, French insiders tell us that the Avro delta-wing bomber has made its first flight, powered by four Bristol Olympus engines developing 10,000-12,000 lb thrust each. It weighs about 190,000 lb." Avros and Bristols *will* be interested.

Aircrew Tests at Sixteen

BOYS of sixteen can now be tested for R.A.F. aircrew training under an extension of the pre-assessment scheme introduced in 1951 for boys of 17. Lads of good education, and with an ambition to fly, will now be able to find out whether they have the necessary physical and mental qualities. This facility will aid all types of potential R.A.F. aircrew: (*a*) the boy who intends to try for a cadetship at the R.A.F. College, Cranwell, at 17½, with a view to obtaining a permanent commission in the General Duties (Flying) Branch; (*b*) the boy who hopes later to join on the regular aircrew engagement of eight years; and (*c*) the National Service entrant who wishes either to train for aircrew duties during his two years' whole-time service or for the four-year special National Service aircrew engagement.

Boys of 16 who are educated to a standard broadly represented by a General Certificate of Education (though they may not hold the certificate at the time) are eligible for this pre-assessment. They can apply through their headmasters or through the nearest R.A.F. recruiting office.

Communist Air Power In Korea

MR. CHURCHILL'S statement to the Commons on May 28th regarding the military situation in Korea showed that Communist air power had been considerably strengthened during the period of the truce talks.

Despite U.N. air superiority over the immediate battle area, he said, the enemy had been able to build up large stocks of all types of supplies during the past ten months. There had been a marked increase in the size of the enemy air forces, which had about 1,800 aircraft compared with some 1,000 aircraft last July. About a thousand of these aircraft were jet fighters, mostly Mig-15s.

The Prime Minister, in his survey of military operations, said that while ground operations had only been on a small scale since last July—when the truce talks began—U.N. air forces were carrying out regular heavy attacks against enemy positions. They were playing a very important part in limiting the enemy's chances of launching a successful offensive. Their chief task was to put out of action and keep unserviceable the major North Korean airfields capable of being used for jet-fighter operations. That this effort had proved successful was demonstrated by the fact that accurate night bombing had made the Communists abandon their attempt to base jet fighters on three new airfields, which they constructed in the Sinanju area last autumn, and on two other airfields, which they had enlarged to accommodate jet aircraft.

The result of these operations had been that the United Nations had air superiority over the immediate battle area. A large proportion of the Chinese aircraft were still stationed in Manchuria, and the lack of forward airfields would seriously handicap them if they attempted to carry out a sustained offensive.

The other main objective of the attacks by U.N. air forces was to disrupt the flow of supplies to the enemy, to limit their troop movements, and to destroy their supply areas. The success of these attacks had severely restricted rail traffic and had limited vehicle movement almost entirely to the hours of darkness.

As part of this campaign, the Royal Air Force Sunderland squadrons continued to take an active part in anti-submarine and shipping patrols which ensured the security of the sea lines of supply between Japan and Korea. A number of R.A.F. fighter pilots had been serving with American squadrons and had acquitted themselves with distinction. South African and Australian squadrons had also been playing their part.

Mr. Churchill agreed with Mr. Emanuel Shinwell that his survey represented a "very grave" situation. Communist forces

AWARDS AND MEDALS: AN R.Ae.S. OCCASION

Before the Wilbur Wright Memorial Lecture, delivered on Thursday of last week, the Royal Aeronautical Society's medals and awards were presented, as is customary. Below, Mr. G. R. Edwards is seen receiving the British Gold Medal from Mr. G. H. Dowty, president of the Society. Among other recipients were, left to right: Prof. T. von Karman (the Society's Gold Medal—highest honour which the R.Ae.S. can confer, for "work of an outstanding nature in aeronautics"); Mr. H. H. Gardner (Simms Gold Medal); and Messrs. P. J. Palmer and S. C. Redshaw (Orville Wright Prize). A list of recipients of the ten R.Ae.S. awards appeared in "Flight" of May 2nd, and the Wilbur Wright Lecture was reported last week.

"Flight" photographs

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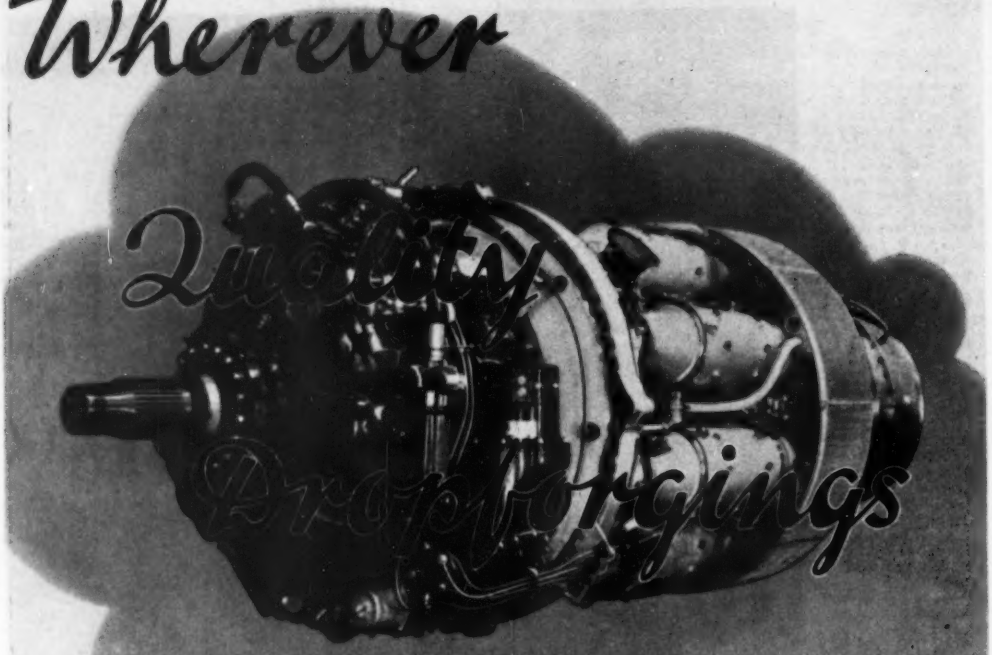

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FROM ALL QUARTERS . . .

now numbered almost one million men, compared with just over 500,000 last July. The enemy's strength in armour and artillery had also steadily mounted.

Mr. Arthur Henderson (Lab., Rowley Regis and Tipton) asked whether, in view of the very large number of trained and experienced pilots required to maintain the front-line Communist strength of 1,000 jet aircraft, there was any evidence as to the nationality of these pilots. Loud laughter greeted Mr. Churchill's reply: "Certainly the Chinese seem to be picking it up very quickly."

P. C. Garratt Honoured

VICE-PRESIDENT, chairman and managing director of the de Havilland Aircraft of Canada, Ltd., Mr. Philip C. Garratt has been awarded the McKee Trophy for 1951 by the Canadian Minister of National Defence. The Trophy is presented annually for meritorious service in the advancement of Canadian aviation, and goes to Mr. Garratt in recognition of his continuous interest and active flying since 1916, and his leadership of de Havilland of Canada, resulting in the design and production of such outstanding aircraft as the Chipmunk, Beaver and Otter.

Mr. Philip C. Garratt.

Mr. Garratt, who is an exceedingly popular figure both in Canada and over here, learned to fly in 1916 at Catterick Bridge, Yorkshire, and later served as a fighter pilot with the R.F.C. on the Western Front. In 1920 and 1921 he was a flying instructor in the Canadian Air Force at Camp Borden. His first association with de Havillands was in 1927, when he undertook test flying for the struggling young Canadian branch of the company at Toronto. In 1936 he was offered the management of the de Havilland Aircraft of Canada, Ltd. Under his leadership a total of 1,747 Tiger Moths were produced in Canada and, following a contract to assemble 375 Ansons, the Toronto plant of the company tooled up for Mosquito production. Since the war, Mr. Garratt has devoted his considerable energies to producing the Chipmunk, and that classic "bush" aircraft, the Beaver, now followed by an even more attractive variant, the DHC-3 Otter.

Commons Questions and Answers

ROYAL AIR FORCE and Naval Aviation affairs were the subject of several questions and answers in the House of Commons last week.

Asked by Mr. Arthur Henderson (Lab., Rowley Regis and Tipton) to make a statement on accidents to Service jet aircraft, Mr. George Ward, Under-Secretary for Air, said that during the first four months of this year there were eight more fatal accidents than in the first four months of 1951. He emphasized, however, that the amount of flying by jet aircraft was now almost twice as great as during the corresponding part of last year, and that the fatal jet-accident rate during the last four months had been substantially lower than for the comparable period last year; in fact, the rate had been steadily falling ever since 1947. It was the constant aim of the Air Minister and his Service advisers to improve still further the safety of jet aircraft, in common with that of all other types.

Capt. Robert Ryder, V.C. (Con., Merton and Morden), was unsuccessful in an attempt to discover what were the terms of reference of the Evershed Committee on Naval Air Organization; what were its conclusions; and what action was being taken to implement its recommendations.

Mr. K. Wingfield Digby, Civil Lord of the Admiralty, commented that during 1944 Sir Raymond Evershed was attached to the Admiralty, on a part-time basis, and undertook an examination of the internal organization of naval aviation, then known as the Fleet Air Arm. His report was a substantial document intended for the advice of the Board of Admiralty of the day. It was not the practice to publish the contents of documents of this kind, or to indicate what measures had been taken as a result of the recommendations contained in them. He regretted, therefore, that he could not give the information requested.

Capt. Ryder then asked Mr. Digby to bear in mind that it was generally considered that the air organization of the Admiralty had many serious defects. Was it not a pity to suppress a valuable report of this nature?

Capt. Ryder later asked what steps were being taken by the First Lord to reduce the delays in development and production of modern naval aircraft.

Mr. Digby replied that the Admiralty was in constant touch with the Ministry of Supply, which was responsible for the development and production of such aircraft, in order to see if there were any ways in which assistance could be given in securing the quickest possible delivery. He recalled that recently it was decided to accord super-priority to the production of the Gannet.

Capt. Ryder acknowledged that fact, but spoke of complaints about serious delays now being experienced.

Mr. J. B. Godber (Con., Grantham and Sleaford) asked why ex-officers re-employed by the Air Ministry as established and certificated civil servants had been specially excluded from the benefit of the increased retiring age of 65 years, recently brought in force for all Treasury-grade Civil Servants; and what was the reason for treating these retired and ex-officers less generously than the majority of Civil Servants.

Mr. George Ward replied that the great majority of substitution officers employed by the Air Ministry had replaced junior R.A.F. officers, and it had therefore been the rule for a number of years that they should retire at 60. All officers were, however, given the chance of further pensionable employment after 60 in a lower grade, in most cases without loss of income.

Mr. George Thomas (Cardiff W.) asked what changes were proposed in the leave schemes for airmen in the Canal Zone.

The Under-Secretary for Air, Mr. George Ward, replied that until recently it had been impracticable to grant normal leave to airmen serving in Egypt because of the unsettled conditions there. Arrangements had now been made for leave travel to Cyprus at public expense. Those who wished to spend their normal leave elsewhere outside Egypt at their own expense could do so.

Advice from Experience

LATELY back from an extensive tour of the U.S. aircraft industry, Mr. Christopher Dykes, M.A., M.Sc., A.F.R.Ae.S., A.F.I.A.S., is establishing himself as an advising aeronautical engineer. His work will cover all aircraft problems, but particularly those arising in air transport, such as the selection of new aircraft and equipment. His offices are at 31 Pembroke Gardens, London, W.8 (Western 9493).

Mr. Christopher Dykes

Mr. Dykes received his aeronautical training at Cambridge University, where he obtained First Class Honours (with Distinction in Radio) in the Mechanical Sciences Tripos in two years, doing research in his third year. He was then awarded the first Commonwealth Fund Scholarship in Aeronautics and studied for two years under Professors von Karman and Millikan at the California Institute of Technology, Pasadena. From 1938 to 1951 he was with British Airways and then with B.O.A.C., the Corporation into which they were merged.

For the last three years Mr. Dykes has been chief engineer (development), B.O.A.C., in charge of the development of all new aircraft and equipment, including the Comet and the Bristol 175. He has originated and introduced a number of new methods of project design and analysis, and to establish forward requirements for new aircraft.

His experience in the United States includes a post, during 1946, as B.O.A.C.'s plant representative at the Boeing works.

Celebrating a Milestone

TO celebrate the delivery to date of £1,000,000 worth of aeronautical equipment to the British aircraft industry, the directors and executives of King Aircraft Corporation, of Hillington, Glasgow, held an informal function at the restaurant at Renfrew Airport on May 17th. All this equipment had been designed and produced by the company.

Among the guests present were Mr. W. R. Enyart and Mr. Howard Holmes, president and vice-president respectively of Simmonds Aerocessories Inc., of Tarrytown, New York, who manufacture and distribute King components in the U.S.A. Mr. Enyart was president of the F.A.I. in 1950.

From a small start at the end of 1941 at Hopetoun Place, Glasgow, King Aircraft Corporation now occupies one of the best-equipped light engineering works in Scotland, situated on the Hillington Trading Estate. Thirty-three current types of British civil and military aircraft (including all the newest jet fighters and bombers) are, it is stated, equipped with one or more of the firm's products.

HERE AND THERE

On Schedule

MR. DUNCAN SANDYS, Minister of Supply, last week sent a telegram to Lord Hives (Rolls-Royce chairman and managing director) congratulating all concerned in the delivery, exactly to time, of the first Avon from the company's Glasgow factory.

The South Coast Race

REGULATIONS for the *Daily Express* Challenge Trophy Race (August 2nd) have now been issued by the Royal Aero Club. As last year, the course is from Shoreham Airport coastwise to Newhaven, overland to Herne Bay, then coastwise back to Shoreham. Prize money is £2,255.

The "508" and "1052" Land On

INITIAL deck-landing trials with the Vickers-Supermarine 508 twin-Avon naval intercepter have just been completed aboard H.M.S. *Eagle*. The pilot was M. J. Lithgow, Supermarine's chief test pilot, and the results were "entirely successful." Trials were also conducted with the Naval version of the swept-wing Hawker P.1052, now, incidentally, having an "acorn" at the intersection of tailplane and fin. Rear Admiral Neil K. Dietrich, U.S.N., was among the distinguished guests entertained by Capt. Guy Willoughby, R.N., during these trials.

Proteus Ratings

DESCRIBED on pages 687-692 of this issue is the Bristol Proteus 705, or Proteus 3, turboprop. For the experimental model, designated Proteus B.Pt.3, a rating of 3,320 shaft horse-power plus 1,200 lb thrust is now officially announced, although an appreciable improvement on this performance has, in fact, been realized, as shown by the figures on page 692. Mention of the Coupled Proteus B.Pt.C.2, delivering 6,640 shaft h.p. plus 2,400 lb thrust, is also authorized.

Heavy Blows in Korea

A BIG supply and factory centre south-west of Pyongyang, the North Korean capital, has lately come in for a great deal of attention from Allied fighter bombers. A strike towards the end of last month was described by the 5th Air Force as being the greatest sustained air attack of the campaign, both in the number of sorties flown and in the destruction caused. In two days 305 buildings, including a hand-grenade factory and a power station, were destroyed and 151 others damaged.

FAMILIARIZATION: Ten Short Sealands have been ordered by the Indian Air Force, which will operate them, mainly for communication duties, from a base at Cochin, on the west coast of Southern India. A party of chief petty officers and petty officers, now at Belfast for instruction in the operation and maintenance of these aircraft, is seen with Mr. Keenan, flight-shed foreman.

IN HARNESS: Mr. P. G. Crabbe, F.R.Ae.S., M.I.P.E., lately appointed managing director of the Gloster Aircraft Co., Ltd. In his former post of director and general manager he contributed much to Meteor production.

Libel?

"THE nacelle, ship-shape and Bristol fashion, and planked in antique teak, ends in a graceful dragonfly tail which keeps the delicate butterfly-wing rudder the necessary 25ft distant from the incandescent boiler."—From an official description of the Shell X-100 (designer, Emett) all-purpose aircraft, one of the new features of the re-opened Festival Pleasure Gardens at Battersea. In view of the fact that the Britannia is to have a cabin-humidifying boiler, it is to be hoped that Filton will not take umbrage at the opening words . . .

Model Occasion

THE Lady Mayoress of London, accompanied by two ceremonial officers of the City, is to present the Queen's Cup at this year's Gala Day of the Northern Heights Model Flying Club, fixed for June 29th at Hawker's Airfield, Langley.

Industrial Turbomécas

THE names Piméné, Oredon, Artouste and Palas distinguish the four little Turboméca aircraft power plants. Some ingenious juggling has now produced Pimédon and Palouste, which are both industrial gas turbines supplying compressed air. Blackburn and General Aircraft, Ltd., who are interested in the Turboméca units, have a Palouste under test at Jarrow-on-Tyne.

Electro-forged Blades

SINCE the article on page 686 closed for press, Omes Ltd., have advised us of certain amendments which should be made to the description of their electro-forging blade-manufacturing process. First, they wish to emphasize that the technique is a patented one. Secondly, it is pointed out that grain-size growth is more a function of temperature than of time, and that slight growth is inevitable.

Pest Control Re-equipment

CONTINUED improvement in the operational efficiency of the aviation division of Pest Control, Ltd., following its re-equipment with Hiller helicopters, was reported by the chairman, the Rt. Hon. Lord Boyd-Orr, at the company's annual general meeting on May 26th. "This helicopter is most economical in operation," said Lord Boyd-Orr. The new fleet, he added, had been operating in the Sudan, South Africa and Great Britain.

Honour for Sperry Chairman

THE President of the French Republic has appointed Mr. Arthur Hillier, O.B.E., J.P., an Officier de la Légion d'Honneur, "in recognition of the contribution which he has made to French aviation since the end of the first World War." This contribution has been through the medium of the

TAKE-OFF IN 160 YARDS is claimed for the Turboméca-powered Frati F-5 trainer, the first complete view of which is reproduced here. A picture of the jet installation was published in our issue of May 16th. A speed of 250 m.p.h. at 19,500ft is estimated.

Do you know your airfields?

22

Recognise this airfield? It's No. 22 in this series of puzzle photographs. You'll find the answer below on the right. ★

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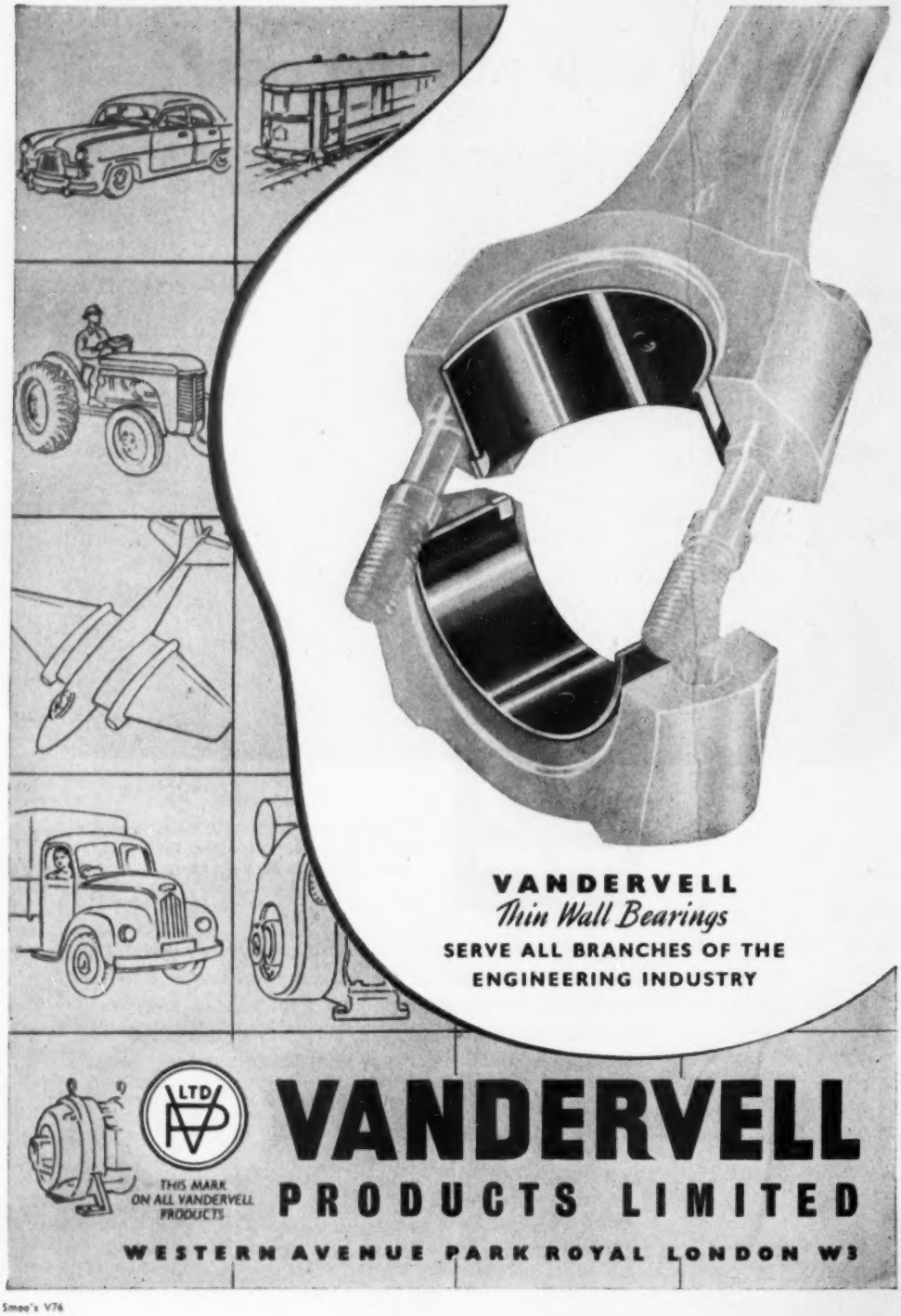
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HERE AND THERE . . .

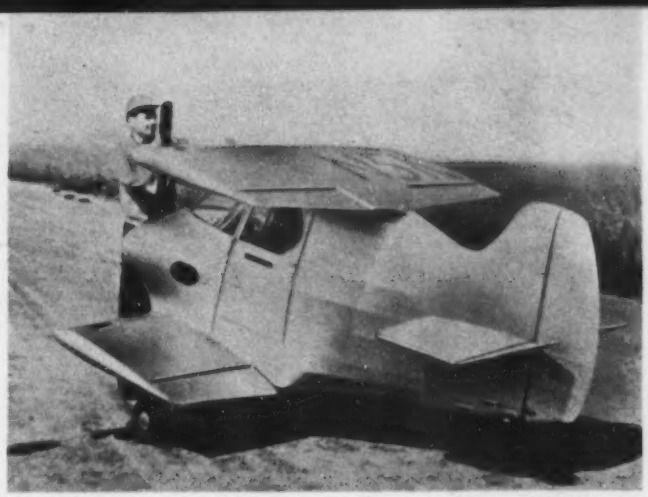
close and cordial relations established and maintained by his company—the Sperry Gyroscope Co., Ltd.—with the French aircraft industry and the French Army Air Force. This is the second foreign honour conferred upon Mr. Hillier. In August, 1950, the Netherlands Government appointed him a Commander of the Order of Oranje Nassau.

Good Taste

TWO well-known airlines are mentioned in *Design and Policy in Industry*, a booklet published by the Council of Industrial Design. "British Overseas Airways Corporation," says the booklet, "is identified at all points of contact with the general public by its consistent use of the same colours, material, insignia and detail design, and the initials B.O.A.C. are made easily recognizable on aircraft, road vehicles and printed matter by the use of one type-face, Cyclone." Examples are illustrated, and the booklet (which is obtainable at 3s 6d from the Council's H.Q. at Tilbury House, Petty France, London, S.W.1) then goes on to deal with K.L.M., the striking architecture of whose offices at the Hague is shown in a photograph.

Mediterranean Research

AN important series of cosmic-ray explorations by radiosonde began at Naples last week, conducted by a six-nation team under the leadership of Prof. C. F. Powell, of Bristol University. The courses of the balloons—which included both small synthetic-rubber types and the large transparent-plastic variety, of up to 150ft diameter, developed by the University—were plotted by radar. On receipt of a radio signal from a balloon's automatic transmitter, denoting that its instrument-carrying parachute had been released, Italian Air Force reconnaissance aircraft set off across the Mediterranean to spot the parachute, which was expected to take 45 minutes to descend from 80,000ft; the aircraft then guided a corvette to the spot. The principal recording instruments employed were special photographic plates sensitive to cosmic rays.



WHY WORRY ABOUT WINGS? Suggestive of American racing-aircraft practice carried to an even further extreme, this biplane—powered by an 85 h.p. engine, make unstated, but evidently horizontally opposed—has a span of 7ft 2in and an overall length of 9ft 10in. Built by one Raymond Stits of Palm Springs, California, it was due to make its first flight a week or so ago.

IN BRIEF

WALKIE-TALKIE radio equipment by Pye, weighing only 8½ lb and with a 60-mile range, is being installed in each of the five Slingsby Sky sailplanes of the British competitors competing in the International Gliding Contests in Spain next month.

* * *

Whitehouse Industries, Ltd. (Philidas Division) announce the appointment of Mr. Gordon E. West as London and Home Counties sales manager. From 1934 to 1946 he was with Simmonds Aerocessories.

* * *

Venner, Ltd., state that their time-switches are incorporated in the D.H. Comet's electrically actuated fire-extinguishing system. Vampire ignition systems, also, have Venner time-delay switches, designed to switch on the "high-ignition" side of the system for a predetermined period, and to assist in starting and re-lighting.

Dealing mainly with business in the heavier B.I.C.C. products, the recently issued annual report of British Insulated Callendar's Cables, Ltd., is an impressive publication of 32 large pages, illustrated and on art paper.

* * *

Motor Transport for tomorrow, June 7th, will be a "Specialized Transport" Number covering the operation of commercial vehicles other than the orthodox bus, lorry or van; snow-clearance vehicles are among those dealt with.

* * *

The application of the "Bonderizing" process—normally a metal-surface treatment—to tube-drawing, cold forming, extrusion and allied techniques is the subject of the May issue of *Bonderizer*, published by the Metal Finishing Division of the Pyrene Co., Ltd., Great West Road, Brentford, Middlesex.

* * *

Federated Paints, Ltd., Glasgow, state that Strathclyde one-component etching primer (see *Flight*, April 27th, 1951) for non-ferrous metals and plastics has now been granted provisional A.I.D. approval No. 4238 under spec. D.T.D. 900, while the M.o.S. has given approval under spec. C.S. 2626.

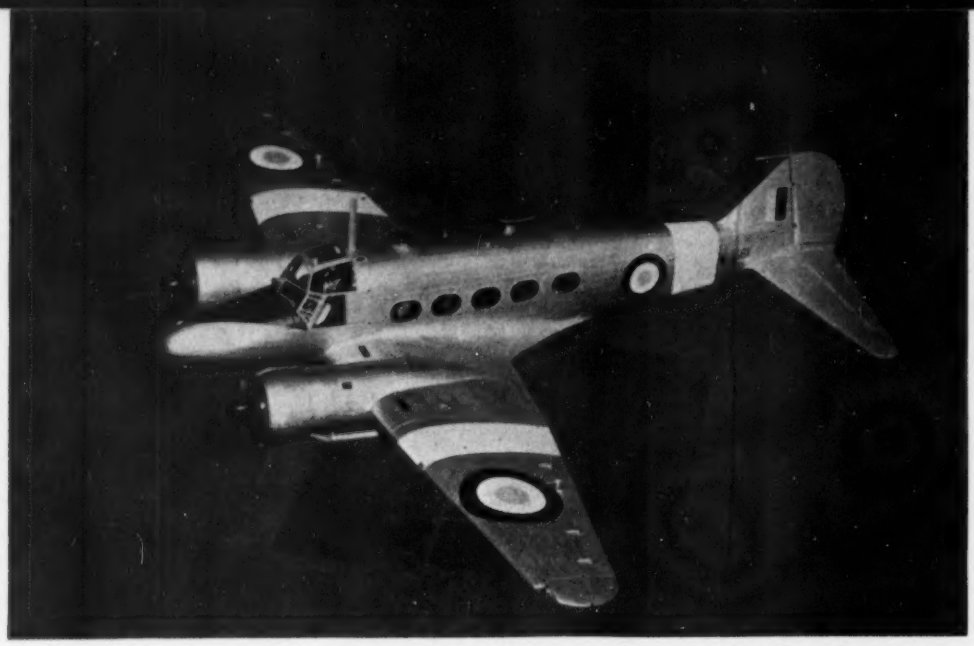
* * *

Mr. W. F. Savage, Wh. Sch., formerly of the Air Registration Board, has been appointed a tutor at the College of Aeronautical Engineering, Sydney Street, Chelsea. He will be especially concerned with candidates for Commercial Pilots' Licences (technical, general and specific types and conversions) for Ministry of Civil Aviation examinations.

* * *

An award for the best industrially sponsored film in Canada in 1951 has gone to *Packaged Power*, a 32-minute, 16-mm colour sound film, produced by Crawley Films, Ltd., for Aluminium Limited, Montreal. Copies of the film—which illustrates the production and use of aluminium—will shortly be available on loan from The Film Library, Aluminium Laboratories, Ltd., Banbury, Oxon.

AIR CHIEF MARSHAL SIR GUY GARROD, chairman of the Air League, looks interested—and perhaps a little surprised—at something he saw during a visit to the Handley Page Cricklewood works last week. With him is Maj. R. E. Nicoll (sales manager) and behind are (left) Mr. F. N. Hillier, the Air League's secretary-general and Mr. C. F. Joy, H.P. deputy chief designer.



An historic photograph taken on May 15th during the last test flight of the last Anson—WJ561. Pilot, J. H. Orrell; flight engineer, D. Wilson.

ANNIE IS A LADY

—*the Last of a Line of 11,020*

A FEW days ago a matronly lady-of-all-work, who "does" for the young men of the R.A.F. and of many other Services and civilian bodies, was bidden into the presence of some very important people and honoured for her 17 years of service. Faithful Annie, they called her; and the old dear must have blushed in her way and remembered the days when, with her distinguished family name and modish figure, she was courted by all the young bloods of the R.A.F. as the most "modern" and—dare we breathe it?—one of the fastest things on wings.

And lest, by remote chance, any reader has failed to follow us in this tribute, we may explain that the lady we speak of is the Avro Anson twin-engined monoplane, and that on May 27th the 11,020th—and positively the last—Anson was formally handed over to the Royal Air Force.

We have it on the authority of A. V. Roe and Co., Ltd., that the story of the Anson really started on May 18th, 1933, when Mr. G. E. Woods-Humphery, then managing director of Imperial Airways, forwarded to Sir John Siddeley (the present Lord Kenilworth) the outlines of a new specification. At that time "Imperials" were operating a number of large machines powered with Armstrong Siddeley engines, from which excellent service was being obtained, and it naturally followed that Woods-Humphery should put up his new ideas—for a small long-range charter machine—to his friend Sir John, who controlled the Armstrong Siddeley Development Company, of which A. V. Roe and Co., Ltd., was a member. After due cogitation Sir John passed on the letter to Avro's "two Roys"—Dobson and Chadwick—who had accumulated a great deal of experience with the Fokker method of welded tubular construction in relatively large machines and who were now asked to build a machine to carry four passengers for 420 miles at a cruising speed of not less than 130 m.p.h.—and, if possible, at 150 m.p.h. Stalling speed was not to be higher than 60 m.p.h., and the choice of two or four engines was optional, though it was laid down that a minimum height of 2,000ft was to be maintained with one engine out of action.

By August, 1933, Avro's ideas had been set down in the form of a design study bearing the type number 652. It was calculated that two Armstrong Siddeley Cheetah V engines would give a cruising speed of 150 m.p.h. and that the still-air range should be 600 miles. The gross weight was estimated to be 6,500 lb, and either welded steel tubes or plywood construction was to be used for the fuselage. The undercarriage was to be retractable, in conformity with the most advanced thinking of the period.

During the winter of 1933/34 Mr. Woods-Humphery was considering the proposals, and his further stipulation that the machine should be suitable for the Karachi-Bombay-Colombo mail run pushed up the weight to 7,647 lb, including the necessary night-flying equipment. By April, 1934, he had gained sufficient confidence in his specification to order two machines.

Detail design had been under way only four months when a letter arrived at Avros from the Director of Contracts, Air Ministry, notifying the company that the Directorate wished to consider the suitability of a twin-engined landplane for coastal-reconnais-

ANSON MARKS

Mk 1	British-built aircraft with Cheetah 9 engines.
Mk 2	Canadian-built, with Jacobs Type L-6MB engines. Later modified to incorporate Vidal moulded-plywood nose and Dowty hydraulic undercarriage and flaps. Was adopted by the U.S. Army Air Corps as a standard trainer and designated AT-20.
Mk 3	British-built airframe fitted (in Canada) with Jacobs Type L-6MB engines. Later modified to incorporate Dowty hydraulic undercarriage and flaps.
Mk 4	British-built, with Wright Whirlwind R-975E3 engines.
Mk 5	Canadian-built, with Vidal moulded veneer fuselage. Pratt and Whitney R-985 AN 12B or 14B engines, Hamilton or Hoover constant-speed airscrews. Navigational trainer (no turret).
Mk 6	Canadian-built, with Vidal moulded veneer fuselage, Pratt and Whitney R-985 AN 14B engines, Bristol Type 1 Mk 6 turret. Armament trainer.
Mks 7, 8 and 9	Reserved for new versions of Canadian-built aircraft. Not used.
Mk 10	Interim communication and ambulance aircraft with standard fuselage. Series 1: Cheetah 9 engines, without hydraulic undercarriage. Series 2: Cheetah 19 engines, with hydraulic undercarriage. (These aircraft were used by Air Transport Auxiliary.)
Mk 11	Communication and ambulance aircraft with deep fuselage. Cheetah 19 engines and hydraulic undercarriage. Fairey-Reed fixed-pitch metal airscrews.
Mk 12	Communication aircraft with deep fuselage. Cheetah 15 engines, Rotol v.p. airscrews and hydraulic undercarriage.
Mks 13 and 14	Reserved for further turret-gunnery aircraft. None built.
Mks 15 and 16	Reserved for further navigation and bombing training aircraft. None built.
Mk 17	Not allocated.
Mk 18	Bombing, gunnery and radio trainer for the Royal Afghan Air Force. Metal wings and tail.
Mk 18c	Civil aircrew trainer for Indian Government. Metal wings and tail.
Mk 19	Communication aircraft and civil feederliner. Series 1: Cheetah 15 engines, Rotol v.p. airscrews and hydraulic undercarriage, wooden wings. Series 2: Cheetah 15 engines, metal wings and tail unit.
Mk 20	R.A.F. navigational trainer (Rhodesia). Cheetah 15 engines, hydraulic undercarriage, and Rotol v.p. airscrews. Metal wing and tail.
Mk 21	R.A.F. navigational trainer (home). Cheetah 15 or 17 engines, hydraulic undercarriage, and Rotol v.p. airscrews. Metal wings and tail.
Mk 22	R.A.F. radio trainer. Cheetah 17 engines, hydraulic undercarriage, and Rotol v.p. airscrews. Metal wings and tail.

An English Electric Canberra powered by two Sapphire engines on test at an Armstrong Siddeley experimental establishment. Constant research in the Esso laboratories is directed towards the development of finer jet fuels and lubricants.

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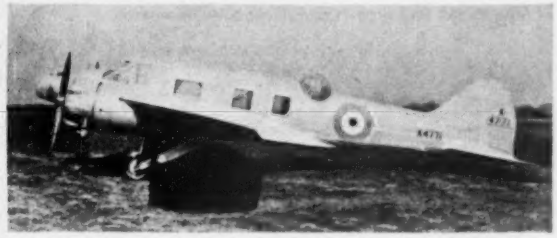
T 80

The Avro 652, as originally built for Imperial Airways.



The prototype Avro 652A coastal-reconnaissance aircraft.

Late-series Anson Mk I, with Bristol turret.

ANNIE IS A LADY . . .

sance duties. The specified load tallied almost exactly with that of the Imperial Airways machine, and the invitation to tender was doubly satisfactory in asking for "details of the extent to which any of your existing types can be adapted to meet the requirements."

The new design study was completed by May 19th. Designated Avro 652A, the proposed machine was to have Cheetah VI engines and tankage was sufficient for a duration of 3.75 hr, cruising at 160 m.p.h. at 6,000ft. Alternative positions for the dorsal Lewis gun—between the spars, or aft of the trailing edge—were offered, and the latter position was eventually decided upon, with the added refinement of a cupola.

In all, 15 different designs were submitted by various firms to meet the same specification, and from these the 652A and a conversion of the D.H.89 were ordered as prototypes. Avros were given six months in which to design and build their machine—a militarized version of a type which itself had not yet flown. Delivery was required by March, 1935, and during October, 1934, tests were rushed to completion in Armstrong Whitworth's wind tunnel at Coventry.

The first machine of the Imperial Airways order made its maiden flight on January 7th, 1935, and it was soon apparent that, with a few adjustments, its handling qualities would not only sustain, but enhance, Avro's reputation in this respect. The pilot, F. B. Tomkins, reported, "If, with feet off the rudder pedals, either engine is switched off, the machine will swing about 15 deg or so to the side of the throttled engine and then swing back and carry on on a straight course." The two 652s—*Avalon* (G-ACRM) and *Avatar* (G-ACRN)—received their certificates of airworthiness during the first week of March, 1935, and were delivered together on March 11th.

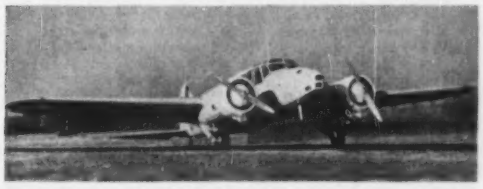
The military prototype—K4771—was first airborne on March 24th, with S. A. ("Bill") Thorn as pilot, and one month later the machine was delivered to Martlesham Heath to undergo its official trials at a gross weight of 7,400 lb. Preliminary tests disclosed the desirability of increasing the tailplane span by 20 per cent and reducing the elevator/tailplane area ratio from 51.5 per cent to 31 per cent, and when these modifications had been effected Service trials of the 652A and the D.H.89 were undertaken by the Coast Defence Development Unit at Gosport.

It was during this period (May 11th-17th) that the present writer was privileged to fly in the gun turret of the 652A during a mock combat with a Hawker Hart. He wrote of the Avro, "It is fitted with two supercharged Siddeley Cheetahs, giving a top speed in the neighbourhood of 190 m.p.h. In the nose there is a bomber's compartment, with the pilot's cabin, navigator's compartment and W/T compartment behind. To the rear of the W/T compartment is a gun turret, or 'parrot cage,' of the Armstrong Whitworth type, half of which protrudes above the top fuselage decking. At present the take-off is somewhat extended, but split flaps and c.p. airscrews should—and probably will—attend to that."

For those days the speed and manœuvrability of the machine were extraordinary, and into the bargain it had inherited many of the amenities of its civil precursor, as witness the following, written on the same occasion as the above quotation: "Certainly the 652A is an aeroplane fit for gentlemen to fight from. Except in very tight turns, when 'g' took a hand in the proceedings (despite her 56ft span, the Avro is outstandingly nimble), one could just sit and shoot, or be shot at, as the case might be."

Soon after the trials at Gosport a fleet exercise off the East Coast afforded an opportunity for the 652A to demonstrate its superiority in range and endurance over its rival, and on May 24th, 1935, Air Chief Marshal Sir Edward Ellington, Chief of Air Staff, decided that it should be adopted as standard equipment for the new general-reconnaissance squadrons. Accordingly, Specification 18/35, written round K4771, and listing 38 special requirements, was issued in August. Among the senior officers who took part in the discussions at that time were Air Marshal Sir Hugh Dowding (Air Member for Supply and Research), G/C. C. F. A. Portal (Director of Plans), and G/C. A. T. Harris (Deputy Director of Operations).

The 18/35 prototype was registered K6152 and was flown for the first time on December 31st, 1935, by Geoffrey Tyson. By this time the name Anson had been officially promulgated. It was intended from the outset to install Cheetah IX engines, which would enable the machine to achieve at 6,000ft the sea-level performance of the civil 652; but it was not until 1936 that the Cheetah IXs became available for installation. By this time the gross weight had risen to 7,500 lb and stability tests at that figure were satisfactorily completed on January 31st, 1936. An Avro foreign sales brochure of the period recorded an R.A.F. order for



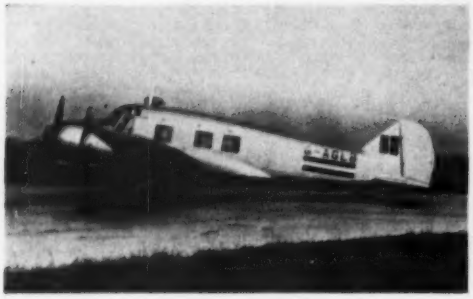
Anson Mk 2 (Canadian-built, with Jacobs engines). U.S.A.F. AT-20.

174 Ansons and further contracts were placed in quick succession by Australia, Egypt, Finland, Greece and Eire.

It was these orders that opened the way for the vast production to follow—production which rose to a rate of one aircraft a day before the end of 1936 and which was to continue uninterrupted for 17 years, reaching a peak output of 130 a month from the Avro factory at Yeadon during 1943/44 and ultimately totalling 11,020 aircraft. Of these, 2,882 were built in Canada by Federal Aircraft, Ltd., a company formed specially for the manufacture of the type.

The first squadron to receive Ansons was No. 48, stationed at Manston, and their first machine was delivered to them on March 6th, 1936. The station commander at that time was G/C. W. V. Strugnel, and S/L. T. A. Langford-Sainsbury was in command of No. 48 Squadron. In the same month, incidentally, a project for a floatplane version of the Anson was put in hand, but for various reasons was never pursued. That project is, however, of interest in that the estimated gross weight was 8,100 lb—a pointer to future development.

During October, 1936, the first aircraft delivered to Egypt was cleared for a take-off weight of 8,000 lb. In reality this was a "652 Mk II," though it bore a stronger resemblance externally to the military Anson than to the original Imperial Airways' machines. At the same period flaps were being developed to steepen the glide.



Anson Mk 12 (communication aircraft with deep fuselage).

Anson Mk 18C (civil aircrew trainer for the Indian Government).

ANNIE IS A LADY . . .

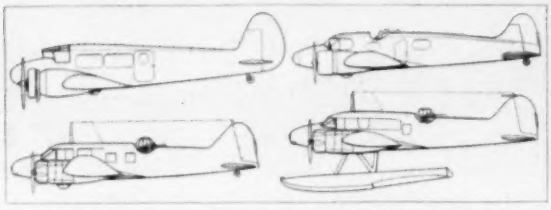
Even before K6152 had made her first flight, Messrs. Dobson and Chadwick had submitted proposals for using the Anson as a trainer; but their scheme did not come to fruition until 1939, when orders for 1,500 Anson I trainers were placed with the company.

It is, of course, as a trainer that the Anson is best known to pilots of the present generation, though it had an important and dangerous, if brief, operational career. In July, 1940, for example, a Coastal Command Anson on reconnaissance shot down a Messerschmitt 110. Though 150 m.p.h. or so slower than the Me, the audacious "Annie" intervened when its pilot discovered four of the German fighters machine-gunning British trawlers off the South Coast. Thereupon, the ill-fated 110 left the trawlers and came in for a beam attack. But the Anson's gunner was made of stout stuff and held his fire until the formidable *zerstörer* was well within range. Then he sent it flaming into the sea. It may be remarked that, whereas the Messerschmitt was armed with two cannon and five machine guns, the Anson had a single fixed forward-firing machine gun and a second gun in the turret.

Another Anson displayed similar temerity by intervening in a mêlée wherein it accounted for an He 115 twin-engined seaplane and an He 111 bomber.

On December 18th, 1939, the agreement to launch the vast Commonwealth Air Training Plan was signed, and the Anson was chosen as one of the standard training aircraft. It was proposed to turn out 20,800 aircrew a year from 154 stations, and the Ansons which were collected for the task were a mixed bunch of Avro-built airframes with either Jacobs or Wright engines (these became the Mks 3 and 4), Canadian-built Anson 2s (the first of which flew in August, 1941), and later versions, designated Mks 5 and 6, which were also built in Canada.

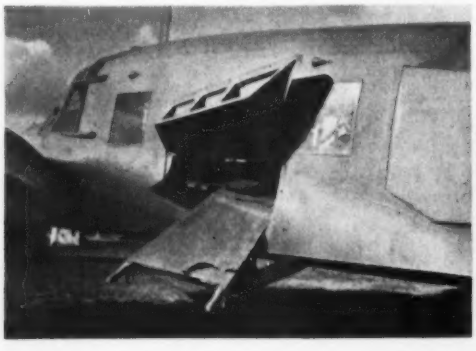
As production gained momentum all Anson Is were converted for armament and navigational training. The characteristics of the various marks are set out in an accompanying table, but we may refer particularly to the Anson 10, which, with its strengthened floor and without the gun turret, was developed for passenger and freight work. This mark flew at a gross weight of 9,450 lb and is particularly associated with the Air Transport Auxiliary, with which organization Ansons logged nearly ten million miles flying.



(Top, left) The aircraft as described in the original proposal to Imperial Airways (August, 1933). (Top, right) The Avro 652A design submitted to the Air Ministry on May 19th, 1934. (Bottom, left) First prototype 652A with Cheetah IX engines and modified rudder. (Bottom, right) Projected seaplane version of the 652A (August, 1936).

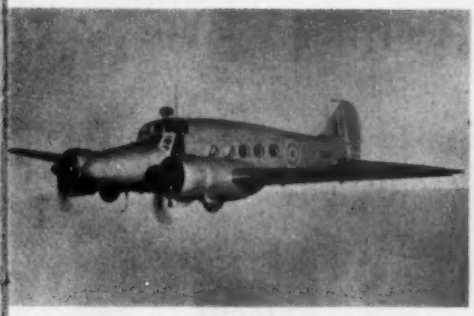
Only eight fatalities occurred with the type and an A.T.A. official has said of it, "Its characteristics were so free of vice and its engines so reliable that it produced an accident rate which, it is believed, has not been bettered in full commercial work." An A.T.A. pilot writes: "At least once—during the 1940 days—I have been aboard an Anson with as many as 13 other guinea-pigs and their parachutes."

Despite the weight penalty imposed by the tubular-steel fuselage construction, Avros were determined to develop the Anson as a post-war passenger and freight-carrying aircraft, and this they successfully accomplished by installing more powerful Cheetahs, driving v.p. airscrews, by increasing the headroom in the fuselage and installing all-metal wings and tailplane. These more modern machines fly at a gross weight of 10,400 lb, and, together with hundreds of earlier marks, continue in service the world over. Mostly they serve for transport and training, but one is never surprised to hear of some new odd job which has fallen to the Annie's lot. Locust-killing, police work in Australia, and supply-ferrying in Canada are routine commitments, and many Ansons work as "hacks" at the various experimental establishments where they are engaged on trials of a more or less secret nature.

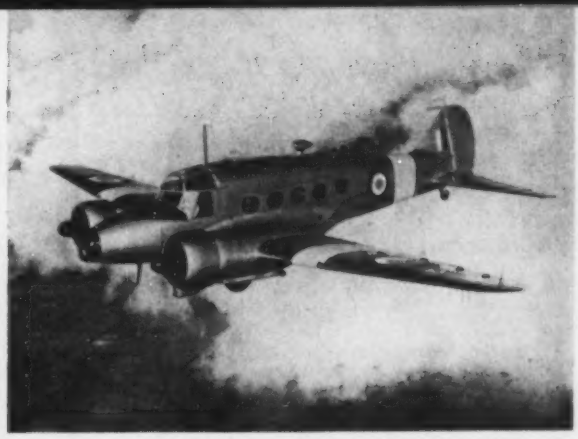


Anson Mk 11 (ambulance version) showing entrance for stretcher.

Avro chief test pilot J. H. Orrell completes his report on WJ561.



Anson Mk 19 (*the civil Avro XIX is similar*).



Anson Mk 20 (*R.A.F. navigational trainer for Rhodesian service*).

It is not, perhaps, generally known that some of the earliest trials of airborne radar were made with an Anson; indeed, what is believed to be the first real proof of the success of this equipment was provided on September 4th, 1937, during Home Fleet and Coastal Command exercises. Soon after the start the weather began to deteriorate, and all Coastal aircraft were recalled by wireless before any fleet sightings had been reported. Not being equipped with wireless, however, the Anson continued about its business under the murkiest circumstances, finally picking up *Courageous*, *Southampton* and attendant destroyers on the radar screen at a range of about 9 miles. In order to confirm the identity of the warships the pilot closed in to within visual range, and *Courageous*, believing an attack to be imminent, despatched her fighters to intercept. As they took off, these, too, duly appeared as "blips." Aided by radar responses from the coastline, the Anson pilot made an accurate landfall, and it is recorded how that evening a surprised Duty Air Staff Officer, who had been led to believe that all flying had been cancelled, received an accurate plot of the fleet's position.

All this was 15 years ago; but, as Sir Roy Dobson, Avro's managing director, remarked when he handed over the 11,020th Anson on May 27th, "Annie's life isn't yet over by a long chalk, and if she goes on for another nine years she will equal the record of the 504 which, as a glider tug, concluded 26 years of service in 1940."

Sir Roy was speaking at Woodford Airfield, Cheshire, and among his guests were: Mr. W. R. McGaw, Director General of Aircraft Production, M.o.S.; Mr. D. W. L. Fairbank, Resident Technical Officer, M.o.S., at A. V. Roe and Co., Ltd.; Mr. L. Pinder, the Principal Inspection Officer, Aeronautical Inspection Directorate, M.o.S., Northern Area; Mr. W. N. Twelvetrees, Inspector-in-charge, A.I.D., at A. V. Roe and Co., Ltd., Chadderton; Mr. J. H. Outhwaite, Inspector-in-charge, A.I.D., at A. V. Roe and Co., Ltd., Woodford; Mr. G. F. Clarke, Armstrong Siddeley Motors, Ltd.; W/C. H. Budden, D.S.O., D.F.C., Wing Commander (Air), 41 Group; and S/L. P. R. Robinson, 41 Group.

"The corner-stone of the Royal Air Force has always been its training system," said Sir Roy, "and I know everybody in the Avro company shares my pride in the contribution made by Faithful Annie to the winning of the last war. Like all articles of quality, she is deservedly having a long life, and when I add her 17 years in production to the 16 of the famous old 504, the total of 33 years isn't very far short of the time I have been in the industry and with the company." Sir Roy recalled the feverish haste to finish the first Anson in the six months allowed, and how he flew down to Gosport, where the Service trials were under way, in the Commodore cabin biplane.

"There have been, to my mind," Sir Roy went on, "two main reasons for Annie's successful career. The first was the genius of Roy Chadwick, who, had he been spared, would today have been mildly surprised at this little ceremony and, inwardly, vastly excited at being on the point of gathering the fruit from another seed which he planted before his death. His genius was a combination of an uncanny flair, a remarkable foresight and quite extraordinary ability. Secondly, Faithful Annie has always had two strong and reliable heart-beats. She began life with Cheetah engines and she will finish life with them. It is no exaggeration to say that the Cheetah V made the original design possible, and the Cheetahs which have followed are worthy of a generous share of any tribute to Annie herself.

"Finally, I want to use this occasion to thank the thousands of men and women who have helped to build 11,020 Ansons. So many of them are with us today that it was found impossible to invite them all, but a very fair representation of the Avro organization is here now. Many of you helped to build the prototype and some of you helped to build the last Anson. Through you, I want to say to all who had a hand in the design and production of this truly great aircraft, 'Thank you, for a good job—a job well done.'"

Thereupon Anson T.21 WJ561 was handed over and went her way.

H.F.K.

PRODUCTION BREAKDOWN

Great Britain

Avro production totalled 8,138 machines—3,537 at Newton Heath, 4,061 at Yeadon, and 540 at Chadderton. Of this total 6,779 were Mk 1; 223 Mks 3 and 4; 103 Mk 10; 90 Mk 11; 246 Mk 12; 13 Mk 18; 12 Mk 18C; 326 Mk 19; 60 Mk 20; 252 Mk 21; and 34 Mk 22.

Canada

A total of 2,882 Ansons was built in Canada, of which 1,832 were Mk 2, and 1,050 Mk 5 and Mk 6.

Anson Mk 1

Of the 6,779 Anson 1s, 313 were fitted at the time of manufacture with a Bristol Type 1 Mk 4 hydraulically-operated turret.

Anson Mk 19

Of the 326 Mk 19 aircraft, 183 were built with metal wings and tail (17 at Yeadon and 166 at Chadderton) and 143 with wooden wings and tail (140 at Yeadon and 3 at Chadderton).

The two "Flight" photographs below were secured at Woodford on the occasion of the handing over of the last Anson. On the left, the machine—a Mk 21 navigational trainer for home service—is seen taxying out to take off. On the right, Mr. J. H. Outhwaite is handing over the log book to W/C. H. Budden, D.S.O., D.F.C., while Sir Roy Dobson (extreme left) and S/L. P. R. Robinson register their pleasure at this transaction.

BLADES BY UPSETTING

An Ingenious Contribution to the Solution of a Gas Turbine Production Problem

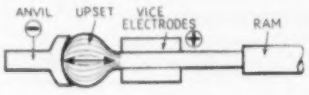
IT has long been appreciated that, except for the smallest parts, forging to shape is an inherently better manufacturing process than machining. Not only does it afford savings in raw material and manufacturing time, but the forging causes the metal to flow smoothly until it assumes the contours of the finished part, thus conferring optimum strength.

Although forging is still usually performed after furnace heating, this method may introduce severe disadvantages. Omes Ltd., of Barnes, London, S.W.13, have long been known for their electro-forging methods which, by heating the workpiece rapidly and uniformly, overcomes many of the usual furnace troubles. The company has also developed a series of upsetting machines which utilize electric-resistance heating to produce a controlled upset at any point on bar stock.

In recent years, this method has been increasingly applied to the manufacture of turbine and axial-compressor blades in any standard blade material. Both rotor and stator blades are in production by the method, with any type of root end or shrouding. Stainless steel, Nimonic alloys, and aluminium- or beryllium-bronze are the principal materials used. Incidentally, pure aluminium has been upset regularly as has—with difficulty—magnesium alloy. For blade production, the upset is of the order of 20 or 25 diameters.

Raw material consists of centreless-ground bar of minimum diameter, this dimension being determined by blade width, but being of the order of ¼in. The stock is cut into accurate lengths of about 1ft each, chamfered at one end; this end is then placed against an anvil on the upsetting machine and the bar gripped fairly firmly in a hydraulic vice.

The brass vice-jaws are water-cooled electrodes (both are anodes) and the similarly-cooled anvil is the cathode. A heavy low-voltage current is passed through that portion of the stock between the vice and anvil; a hydraulic ram then pushes the stock



The ram pushes the workpiece through the vice-electrode to "feed" the upset.

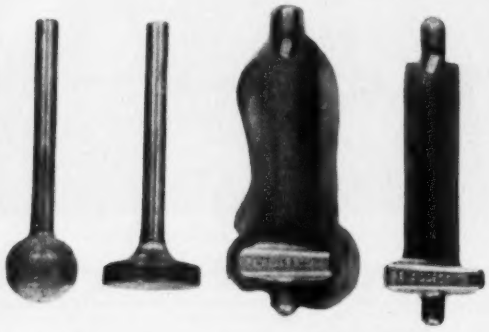
to form the upset, the anvil retracting to allow for the growth. By varying the speed of ram and anvil, corresponding variation can be effected in the shape of the upset.

Current is tapped from the Omes-designed transformer and the machine uses a self-contained water or oil system for ram operation. Once set, the upsetting is automatic—thus permitting operation by semi-skilled workers—and a typical cycle time is 15 sec. The temperature coefficient of resistance of most blade alloys does not vary greatly over the forging range; usual upsetting temperature is 1,050–1,150 deg C, or about 880 deg C for al-bronze.

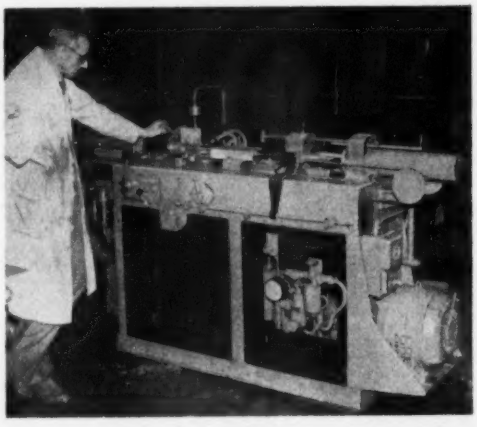
The rapid heating at one end permits the piece to be hand-held in transit to a vertical 500-ton forging press which forms a flat head from the upset. A 10 per cent tungsten, pre-heated die is used, with one forging blow. After a slight re-heat to the appropriate temperature, the piece (which now resembles a mushroom valve) is placed on a horizontal die and forged flat—again at one blow—into a semi-finished blade and root.

A combined coining and trimming operation, usually carried out cold, is then followed by vapour blasting (shot-blasting for stainless steel) and, possibly, electro-polishing. The final forging blow produces a blade contour held within an envelope of ± 0·0005in.

Advantages claimed for this process may be listed as follows: (1) Rapid and uniform heating is obtained throughout, scaling and carburizing being almost eliminated. (2) Precise volumetric control of the workpiece prevents waste and greatly increases die life. (3) Very little is demanded of the operator. (4) The upsetting opens up any minute shake, inclusion or other flaw in the stock; if this becomes apparent, the piece is rejected without further time being spent on it. Equally, the production of a good upset largely guarantees a perfect blade. (5) The whole process affords a very great reduction in the overall time required to produce a blade—the sequence of upset, forge, heat, forge and trim comparing very favourably with the many operations, with re-heats, otherwise required. (6) Perfect grain-flow is produced throughout the blade and root. (7) Material grain-size cannot grow in the brief heating period. (8) The process is carried out entirely with self-contained machines and working conditions are very favourable by comparison with furnace heating.



Stages in the manufacture of an aluminium-bronze compressor blade: (left to right) centreless-ground chamfered bar; after upsetting; after vertical forging; after re-heat and horizontal forging; and after combined coining and trimming the flash.



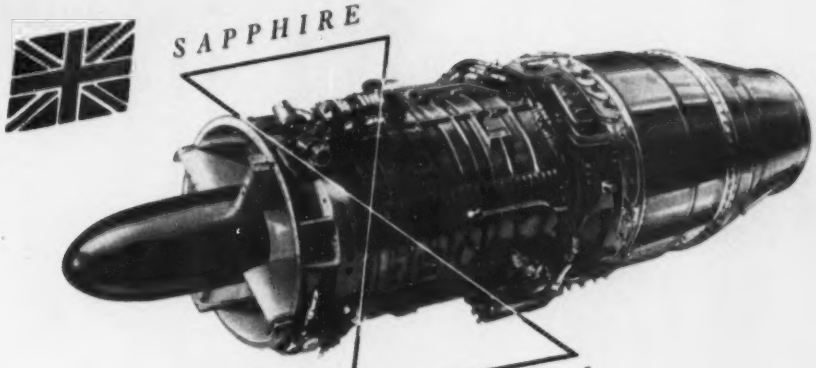
(Below) A typical Omes 15 kVA upsetting machine working on compressor blading. The electrodes are water-cooled and the hydraulic rams are operated by a self-contained water or oil system.

Further developments of the Omes method include the large-scale production of shrouded blades with a precision upset at both ends and—possibly the ultimate in blade production—the upsetting of a continuous aerofoil-section strip. It would appear that complete turbine or compressor blades will eventually be produced in a fraction of a minute, starting with continuous strip.

Among firms stated to be using, or interested in, Omes equipment, may be mentioned Rolls-Royce (Barnoldswick works), the Utica Drop Forge and Tool Co., Avro Canada, and Bofors A.B., Sweden. While details are restricted, it may be said that considerable blade production for many important engines is being carried out by this method.

This noteworthy process is to be described in detail in the July issue of our associated journal *Aircraft Production*.

TWO NAMES . . . ONE ENGINE !



A standard power unit developed for the military aircraft of the North Atlantic Treaty Organisation, the Armstrong Siddeley Sapphire high-thrust turbojet is being manufactured under licence by the Wright Aeronautical Corporation and will be known in the United States of America as the Wright J/65 — a major contribution to Western Defence.

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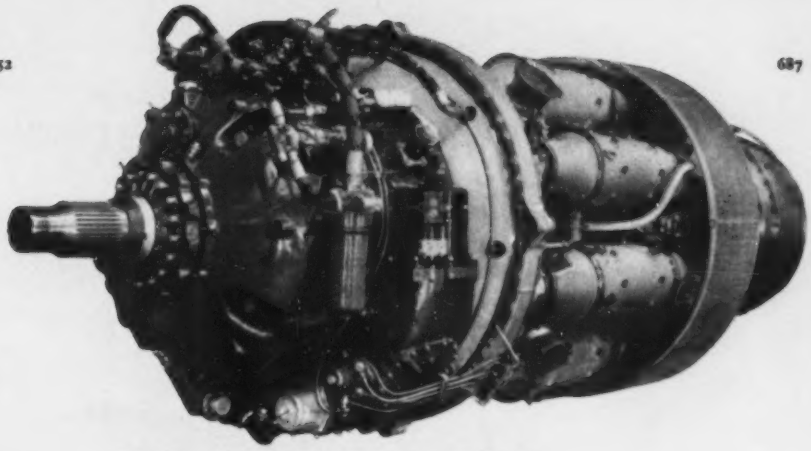


PROTEUS 705

Design Analysis of the Latest Bristol Turboprop: a Compact, Highly Efficient Power-plant

PROTEAN is an adjective which has not appeared often in these pages: it is a word which slips so much more readily from the poet's pen than from that of the more mundane technical journalist. But it flitted into our mind when we sat down to compose this article, and we delved back into the cluttered memories of schooldays to rake up the who, what and why of Proteus. Reference to the lexicon clinched the matter. Proteus, in classical mythology, was a marine deity, the son of Oceanus and Tethys, who had the exceedingly useful if bewildering facility of changing his shape. (Hence, protean.)

The latest version of the Bristol Proteus—generally designated Proteus 3, but known by the makers as the Proteus 705—is clearly a different engine from the earlier marks of the series, but when the company originally chose the name they could, we imagine, scarcely have foreseen that it would turn out to be so appropriate. By comparison with the earlier versions, the 705 is a good deal more compact, is lighter, of higher power and, with this, of greater efficiency in that its specific fuel consumption is less.

Any consideration of the Proteus 705 necessarily demands some reference to the previous versions and, therefore, it might now be as well to make a brief survey of the background before going on to deal with the physical description of the engine. It is nearly three years since the Proteus 1 was described in *Flight* (August 18th 1949), and during this time development of the original design has proceeded without interruption so that the Proteus 2 of today differs markedly from the first engine. The turbine has been modified both aerodynamically and mechanically; the axial compressor is aerodynamically little different, but mechanically has been considerably altered; the final centrifugal-stage compressor has been modified mechanically and aerodynamically and, with this, the reduction gear, although essentially similar, has been modified in detail. It is thus fair to say that, although the physical layout and fundamental design of the first and interim engines are basically the same, in fact both mechanically and in performance the Series 2 is a radically different engine from its predecessor.

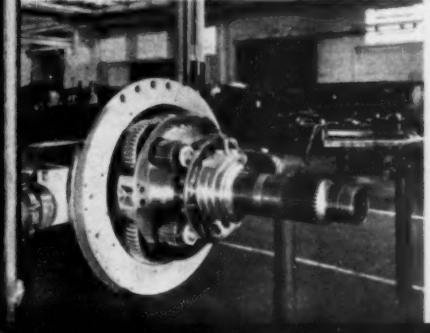
During the development period to date, the Proteus 2 has accumulated something of the order of 10,000 hours of bench running and has, in addition, put in rather over 800 air hours in a Lincoln flying test-bed. It is, as a result, a very reliable engine, and recognition of this was implicit in the granting of a full type-approval certificate on March 3rd this year, following completion of the requisite tests last September. The certificate is valid for a take-off b.h.p. of 2,500, but in point of fact all running for some time now has been on the basis of 2,800 b.h.p. In addition to powering the prototype Britannia, the Proteus 2 in four-coupled and two-single forms will be the power installation for the Saro Princess, and the first flights of both these outstanding aircraft are scheduled for this summer.

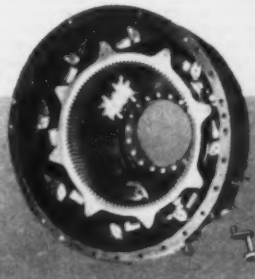
All the improvements made in developing stage by stage the series 1 and series 2 variants, although materially enhancing component performance and overall reliability, did not effect any marked reduction in weight. By contrast, the Proteus 705 is in effect a new engine in which are embodied all the advances made with the earlier versions, coupled with the results of exhaustive rig test work, refinement of detail design, and a stringent monitoring of weight. (It is apposite in this context to recall that a review of Bristol gas turbine research facilities appeared in the May 9th issue of *Flight*.)

There are various ways of describing the physical structure of an engine, and each has its particular merits and its particular disadvantages; it is our view that, in general, the best way is to start at the front, work progressively to the back, and digress from this axial movement as the occasion may warrant. In this instance, the fact that the Proteus is a reverse-flow unit may hamper the continuity of our survey, but it is not, we think, of sufficient moment to warrant a change of attack.

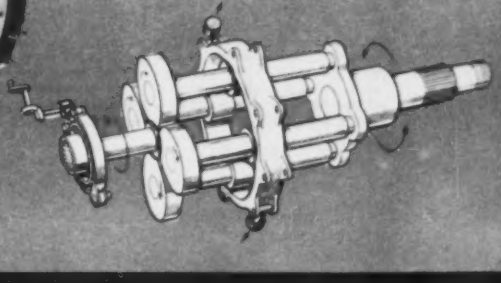
To begin at the beginning, therefore, the reduction gear casing is made up of a series of castings in ZRE 1 magnesium-zirconium, dowelled and bolted together to form a multi-compartmented housing for the reduction gear itself, and for the various drives to the engine auxiliaries. The airscrew shaft is of No. 6 S.B.A.C. standard size, and is formed with a skirt at its rear and which

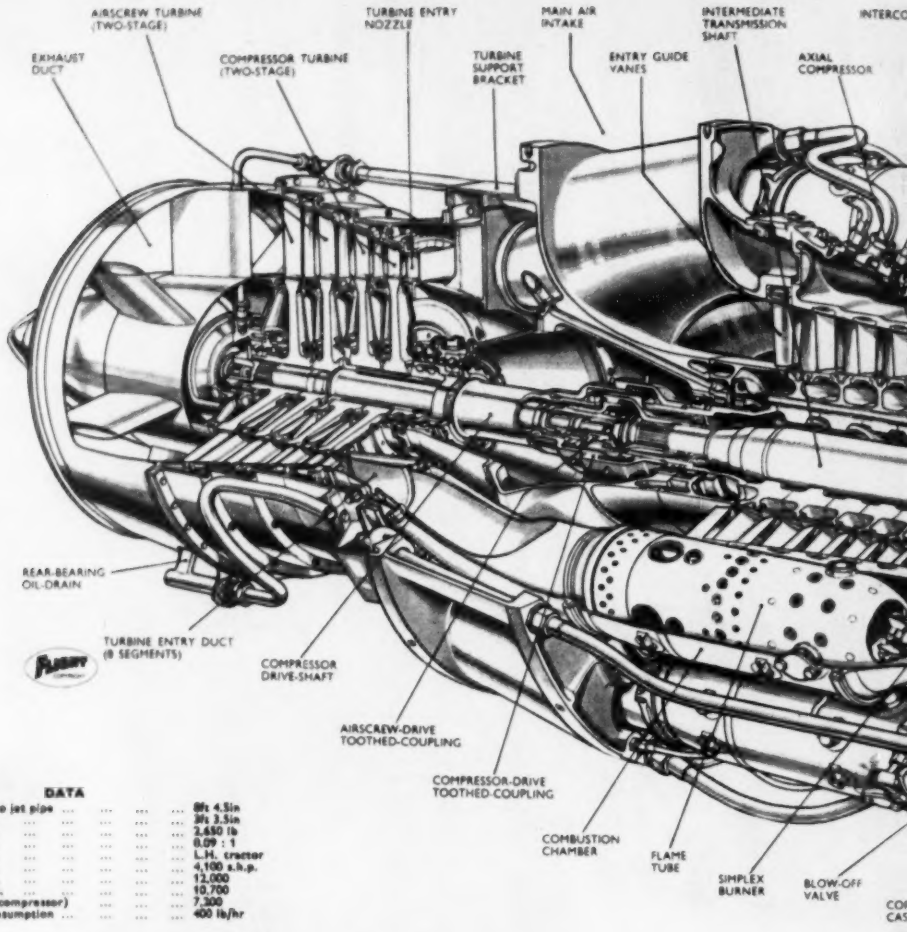
Epicyclic train of the compound reduction gear (seen mounted in assembly fixture), showing the arrangement of the planet primary and secondary pinions in their carrier drum.





(Left) Front casing of reduction gear with floating annulus and torquemeter assemblies installed. (Below) Schematic diagram of reduction gear. It should be noted that, whilst the planets rotate clockwise individually, the planetary assembly as a whole rotates anticlockwise against the fixed annulus. Arrows show the reaction thrust on the torquemeter pistons.





DATA

Length, airscrew cone to jet pipe	8ft 4.5in
Diameter	3ft 3.5in
Weight, bare, dry	2,650 lb
Reduction gear ratio	0.09 : 1
Airscrew rotation	L.H. tractor
Max. s.l. power	4,100 s.h.p.
Max. compressor r.p.m.	12,000
Airscrew turbine, r.p.m.	10,700
Minimum idling speed (compressor)	7,300
Minimum idling fuel consumption	400 lb/hr

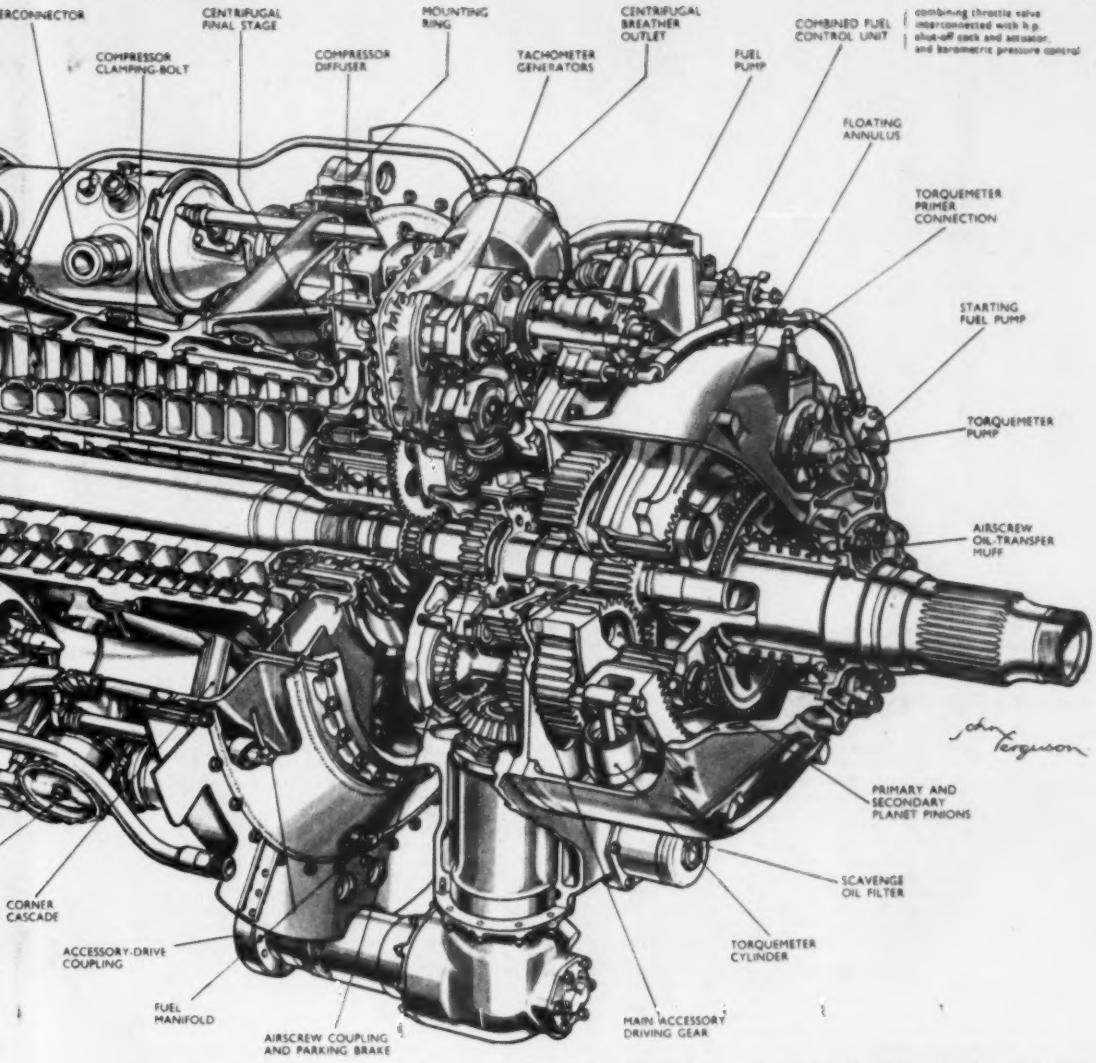
IN making this fine study of the Proteus 705 our artist John Ferguson has arranged the main section-planes to show, in the top portion of the drawing, the flow of air through the entry and the compressor and into the diffuser, whilst the lower section indicates the flow-path out of the diffuser, through the combustion chamber and so to the turbine.

PROTEUS 705 . . .

serves as the front diaphragm of a built-up drum in which are supported the four shafts carrying the planet pinions of the epicyclic train. Front support for the output shaft and reduction gear is vested in a large ball thrust-race housed in the forward mouth of the gear casing, thrust loads being conveyed from shaft to bearing through the medium of the transfer muff by means of which oil for airscrew actuation is delivered from a stationary source to a rotating destination. From the muff, oil is delivered through drillings through the shaft wall to a transfer unit carried within the hollow core of the shaft, and thence through co-axial tubes to the airscrew. Oil from the transfer muff is also taken through drillings to lubricate the planetary gears.

In conformity with past Bristol practice, the fixed annulus gear is not rigidly anchored, but "floats" on the planet secondaries and is "fixed" by reacting against the eight torquemeter assemblies equi-spaced around its periphery and pin-jointed to carrier lugs on the interior of the gear casing. The planet pinion-shafts are white-metalled for the secondary pinions, to which the primary planet pinions are splined, and likewise the sun-gear shaft runs in white-metal bearings, the front bearing being in the tail of the airscrew shaft, and the rear bearing housed in the bore of the rear diaphragm of the planet carrier drum.

The rear bearing for the reduction gear as a whole is a roller housed in the centre wall of the gear case. The inner race of this bearing is carried on the shaft of a dished spur gear, the bore of which is splined to the planet-carrier diaphragm. This gear meshes with a pinion splined to a bevel shaft for drive take-off to the accessories gearbox. The accessories drive is from the bevel shaft—which lies parallel with, and vertically below, the axis of the engine—down through a vertically dependent bevel shaft to a bevel box bolted beneath the gear casing and housing a bevel quill-shaft : this quill-shaft terminates in a coupling for connection to a torque-shaft which would extend back to the accessory gearbox usually mounted behind the firewall. The spur wheel serving as primary input to the drive transmission also performs the same function for the driving trains of the various engine auxiliaries which are grouped around the gear casing. An interesting structural side issue in this connection is that the auxiliary drives are fitted in the inner drum of the gear casing as a complete sub-



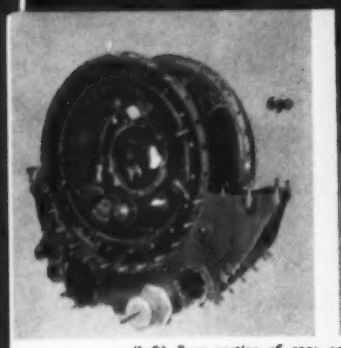
assembly, the various auxiliary units being simply mounted externally and picking up their individual drives.

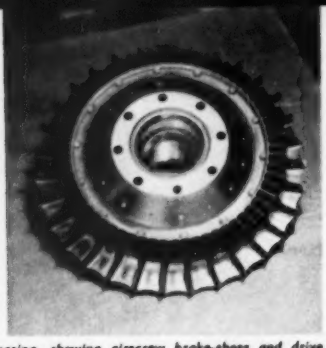
The extreme tail of the sun-gear shaft is serrated for engagement with the drum of the airscrew-parking brake, and this is of two-shoe contracting type operated by an electric actuator through normal toggle linkages. An internally toothed ring gear is formed integrally with the brake drum, and meshes with a spur pinion serrated to the nose of the intermediate transmission shaft, i.e. the shaft which connects the power turbine to the reduction gear. The shaft end-pieces are machined forgings of nitrided steel, the skirts of which are welded to a large-diameter thin-walled tube; the critical whirling speed of the shaft is outside the speed range of the engine, and in this regard blancing bosses are formed on the end forgings.

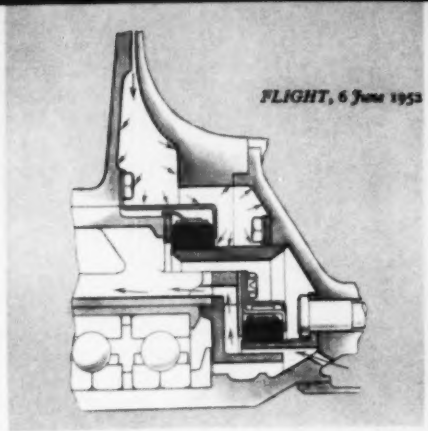
The method of mounting adopted for the Proteus 705 is distinctly unusual but, in its simplicity and fundamental rigidity, should be most efficient. The rear skirt of the reduction gear casing is through-bolted to the compressor diffuser casing—a fine casting in RR 50—and nipped between the two is a conical section steel ring in D.T.D. 184. This is peripherally bolted through a rectangular section ring in conjunction with which (on its rear face) is a further conical section ring, the inner lip of which is bolted up to the compressor casing. To complete the triangulation a third cone ring extends between the diffuser casing and the common attachment to the compressor casing.

The compressor casing (in RR 50) is cast in upper and lower halves bolted together through the horizontal centre plane of the engine. Dovetail-section grooves accommodate the 12 rows of stator blades—lost-wax cast in HR Crown One or, alternatively, forged in D.T.D. 282 stainless steel—and an ingenious system is adopted for the lateral bedding of the blades. Approximately at 30 deg radial stations in each stage are "expander" blades, the roots of which are laterally tapered. Spigots on these blades pierce the casing and serve as draw-bars through which the exertions of coil springs are transmitted. The tapered faces of the blade roots engage complementarily tapered faces on the adjacent blades, and by this means the spring pre-load of the "expander" blades serves to hold the intermediate gangs of blades squeezed up together, and at the same time provides some degree of accommodation for expansion movement.

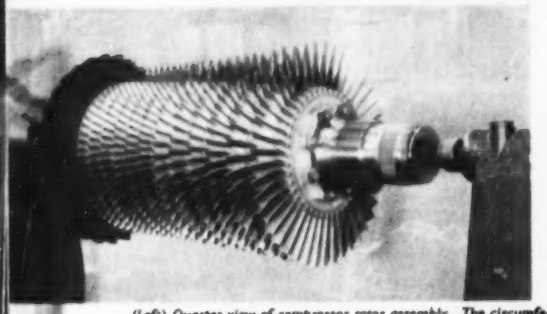
Each of the 12 rotor stages in the axial compressor is comprised of forged D.T.D. 282 blades diagonally fir-tree anchored in forged

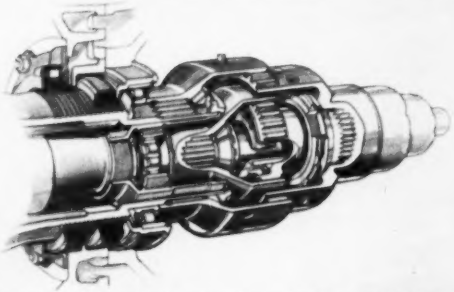






(Left) Rear section of gear casing, showing airscrew brake-shoes and drive take-offs to various auxiliaries. (Centre) Single-sided "open" impeller for centrifugal final compressor stage. (Right) Detail of carbon sealing rings protecting the compressor front bearing. The upper arrows indicate pressure and the lower arrows flow.





(Left) Quarter view of compressor rotor assembly. The circumferential grooves on the shaft are for the twin carbon sealing rings. (Right) Detail of toothed couplings, bearing assemblies and carbon seals at the rear of the compressor. The compressor is driven through the outer coupling and the airscrew by the co-axial inner coupling.

PROTEUS 705 . . .

light-alloy discs of RR 58. Distance pieces maintain accurate axial spacing of the blades at root level, and the individual discs are anchored together in an unusual fashion. Eight high-tensile steel bolts pass through all 12 discs, and compress them together, but these bolts are not subjected to shear; at each inter-disc joint, the bolts pass through "bush" dowels, and it is these dowels which take shear loads. At their forward terminals the bolts engage sleeve-nuts which serve to secure the steel forging that forms the journal for the compressor front bearing, and at the same time is the carrier for the final centrifugal stage. The bearing comprises a pair of tungsten steel deep-groove ball-bearings—Ransome and Marles bearings are used throughout the engine—and as may be seen from the detail sketch, novel use is made of floating carbon rings for pressure sealing.

The Bristol Engine Division have found that, to date, these carbon seals are very effective, in that they are self-grooving and so permit fine clearances—of the order of 0.008in on a 10in i/d; they are manufactured by the Morgan Crucible Co., Ltd. Sealing has, in fact, played a large part in the attainment of the engine's efficiency, primarily in the turbine (of which we shall have more to say later), but also in the compressor. In this regard, the fact that in the Proteus 705 the final centrifugal stage is bolted direct to the axial compressor has obviated the potential source of leakage attendant upon the use of an interposed diffuser. A simple, single-sided "open" impeller is used to boost the 6 : 1 compression ratio of the axial stages by an additional 1.2 : 1, and delivers into a conventional volute diffuser from which the air passes into the entry ducts to the combustion chambers through corner cascades of guide vanes.

Air enters the engine through a beautifully designed and executed casting in RR 50 light-alloy, the essence of which is that the entry passages are formed by (the spaces between) the integral shrouds for the combustion trunks, and thus contamination integrity is ensured—another aspect of attention to sealing. The entry casing is anchored to the compressor casing by multi-studs, and in its centre houses the roller bearing which is the rear support for the compressor rotor; immediately forward of this bearing is another pair of carbon sealing rings. The compressor rear journal is splined to a bell-sleeve, the mouth of which is internally toothed for engagement with complementary teeth on a converse bell-sleeve splined on the nose of the compressor turbine shaft. Co-axially within this assembly is a duplicate, varying only in detail, by means of which the intermediate transmission shaft (to the reduction gear) is united with the output shaft from the power turbine. Rear support for the intermediate transmission-shaft is vested in a roller bearing housed within the bore of the axial compressor's rear journal.

To go back on our descriptive tracks somewhat, air delivery from the compressor issues from the diffuser nozzles and is passed through the corner cascades to the eight combustion chambers which, manufactured by Joseph Lucas, are of aluminium sprayed mild steel. The chambers house Lucas skin-cooled flame tubes of Nimonic 75 which, although conforming to established practice in design, are unusual in that they are of riveted construction. Side-entry Simplex burners discharge downstream into the flame tubes, and the primary air enters past the burner nozzles in a helical flow induced by swirl vanes across the entry annulus. The gases are conducted from the combustion chambers to the turbine entry nozzles by swan-neck convergent tracts (of Nimonic 75) housed within mild steel insulating shrouds. From the convergent tracts, the gases are distributed evenly to the turbine entry nozzles by means of transfer ducts fabricated in Nimonic 75 and so shaped as to translate a circular section entry into an annular segment outlet.

The turbine casing is a step-walled drum which is a fine example of centrifugal casting, the metal being HR Crown One heat-resisting steel. The method of attachment (to the air entry casing) is worthy of note in that eight Z-section sheet-steel brackets angularly equi-spaced are the mounting media; thus, whilst concentricity is assured, radial and linear expansion movement is accommodated.

We have already made reference to the fact that sealing has been the object of close attention in the design of the Proteus 705, and although the Bristol Aeroplane Company is not prepared to divulge the improvement in turbine efficiency obtained by reducing the leaks, it may be taken for granted that the firm is very well satisfied with the dividend paid on its research and development work on gap design. Both the compressor turbine and the airscrew (or power) turbines are two-stage units, and with the exception of the final stage of the latter, all blades in the assembly, both rotor and stator, are fully shrouded. Co-axially surrounding the rotor stages are "leak-control" secondary shroud rings, tongued to retaining rings, dowelled and studded to the casing.

The foremost of these outer shrouds is peripherally dowelled and studded to the turbine nozzle assembly, the roots of the nozzle blades being nipped between the rim of the turbine front

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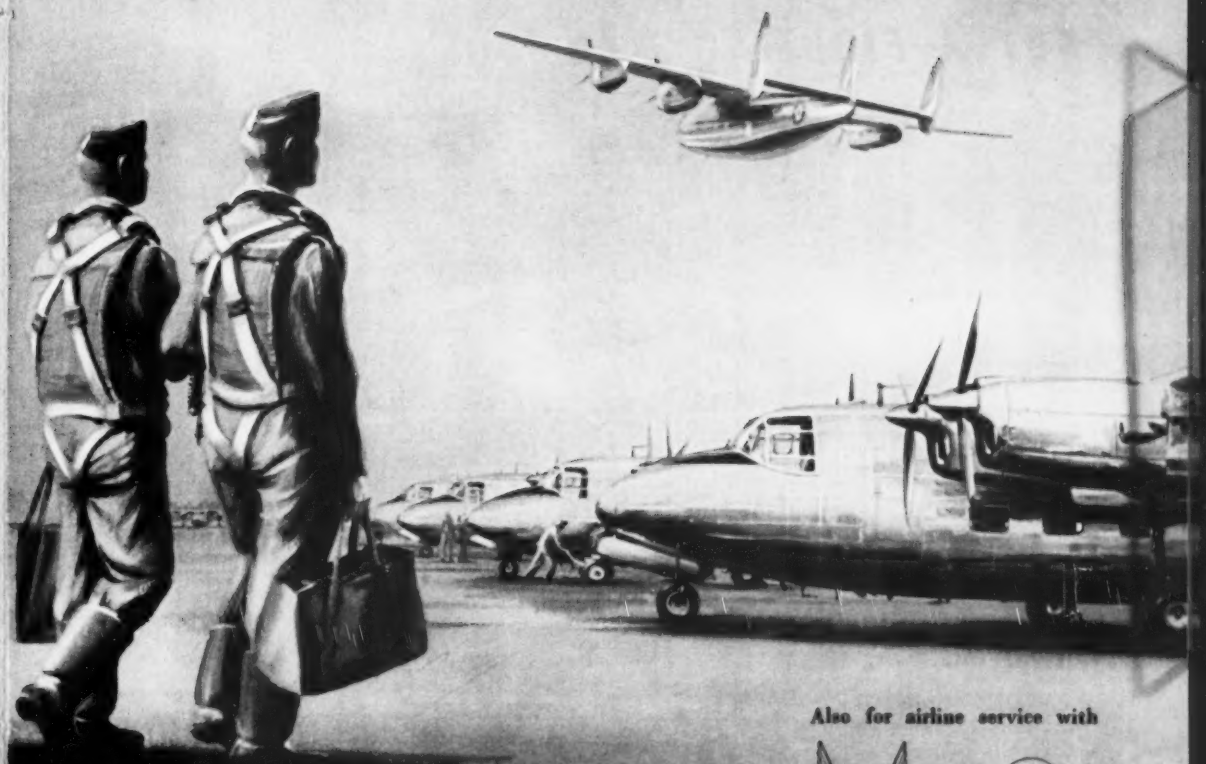

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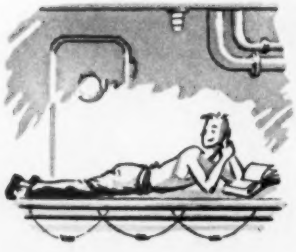

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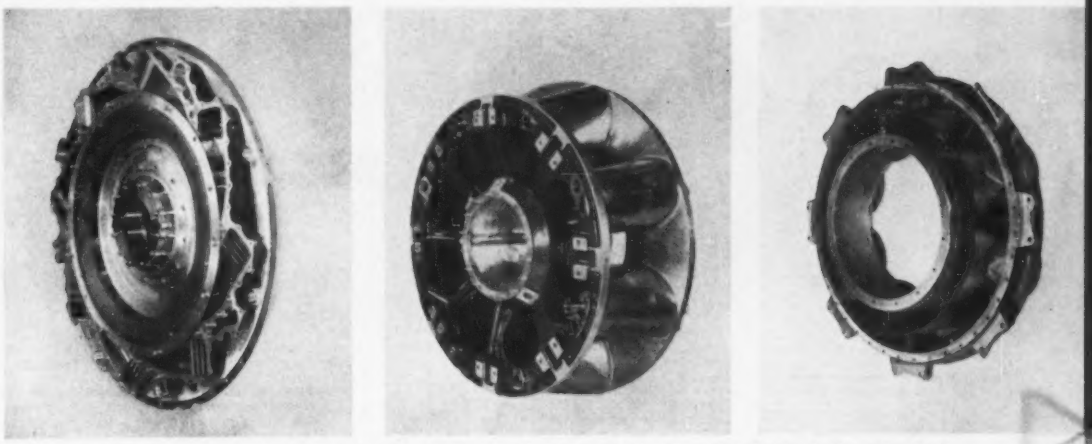
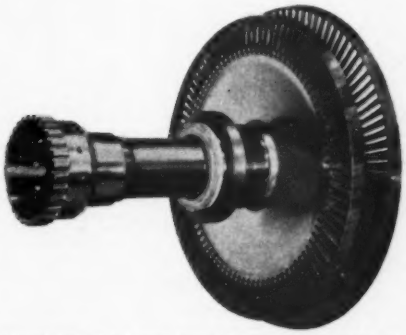
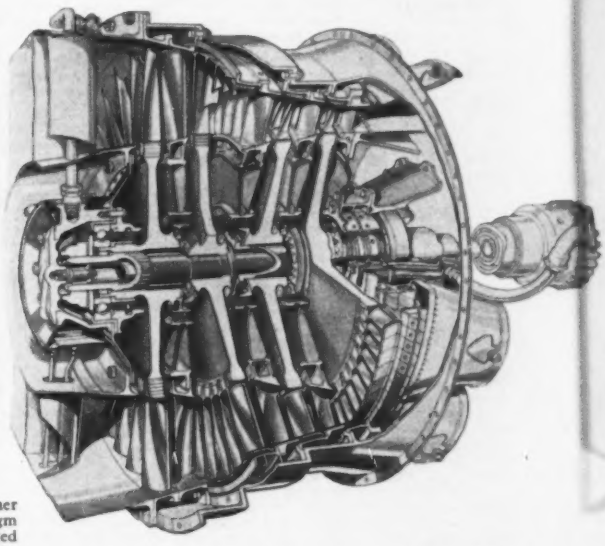


(Left) Diffuser casing of compressor, showing tangential nozzles giving into transfer ducts, across the "elbows" of which are fitted cascades of guide vanes. (Centre) Main air entry casing. The inlet passages are between the shroud ducts through which pass the combustion tracts. (Right) Turbine entry casing, showing the translation of cross section from the combustion tracts to the entry nozzles.



(Above) 1st and 2nd stage rotors (for the compressor turbine) with output shaft, front bearing and toothed-coupling bell-sleeve. (Right) Detail of turbine assembly, showing labyrinth seals, rotor and stator construction, blade forms and inter-disc and disc/shaft couplings.



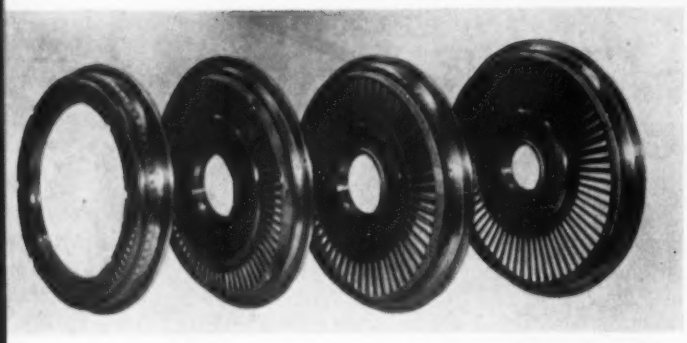
PROTEUS 705 . . .

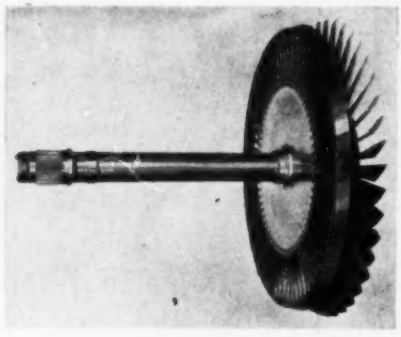
diaphragm and the skirt of a cone ring which forms the inner wall of the turbine entry casing. The turbine front diaphragm is an integrally swaged ring of heat-resisting sheet steel, bolted to a hub in which are formed air passages for cooling the compensated labyrinth housed within the bore of the hub and serving the turbine front support bearing. This bearing is housed at the head of a conical steel ring through-bolted at its skirt to the air entry casing.

Both discs of the compressor two-stage turbine are forgings in Jessops G.18B, united by a Hirth coupling and, indeed, giving torque to the output shaft by means of a similar coupling. Both discs are drawn up to the output shaft by a sleeve-type retaining bolt threaded in the rear mouth of the shaft. The compressor turbine rotor blades are machined from Nimonic 80 bar (as are the entry nozzle blades) and the inter-stage row of stator blades. The stator blades are carried on twin-walled diaphragm assemblies of heat-resisting steel, the bores of which accommodate labyrinth seals.

Although, strictly, it would be correct to speak of the first and second stages of the compressor turbine, and the first and second stages of the power turbine, it is perhaps easier (and not altogether unjustifiable) to refer to the first, second, third and fourth stages of the turbine assembly as a whole: that is to say, the airscrew turbine first and second stages are referred to as the third and fourth turbine stages. On this basis, then, the stator blades between the second and third and between the third and fourth turbine stages are precision castings in HR Crown One—in general, an unusual procedure, although not contrary to previous Bristol practice. Although the third and fourth stage rotor blades are Nimonic 80, the turbine discs are forgings of Jessops H.46 or, alternatively, Rex 448, and they, too, are united through a Hirth coupling. Torque is given to the output shaft through splines in the bore of the fourth-stage disc. In all four turbine stages the blades are diagonally fir-tree anchored in the disc peripheries.

Rear support for the turbine assembly is provided by a tungsten steel deep-groove ball-bearing carried on the hub of the fourth-stage disc. The bearing is enclosed within a light-alloy housing which also serves as a distributor for oil feeds to the front and rear bearing assemblies. The housing is studded commonly to the labyrinth seal assembly guarding the rear bearing, and to a dished ring of heat-resisting steel flange-bolted to the i/d of the turbine exit duct. This last is fabricated in sheet stainless steel, the turbine discharge area being divided by seven aerofoil-section spokes spanning the inner and outer drums of the duct. To the





(Above, left) Complete turbine stator assembly, including secondary "leak-control" shroud rings. (Right) Third and fourth stage rotors (for the airscrew turbine) complete with output shaft. Note that the final-stage blades are not shrouded.

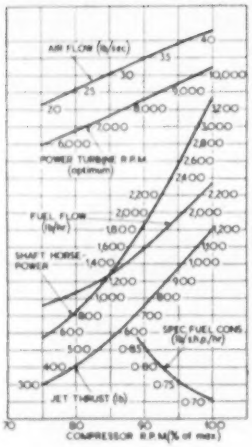


Fig. 1 (extreme left) Designed performance curves of sea level static performance in I.C.A.N. conditions.

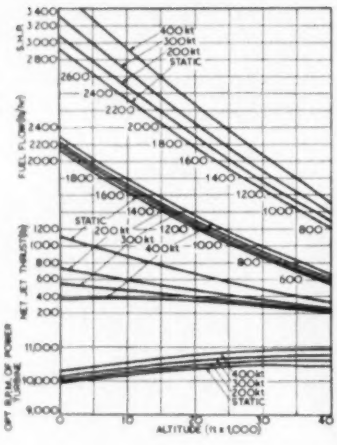
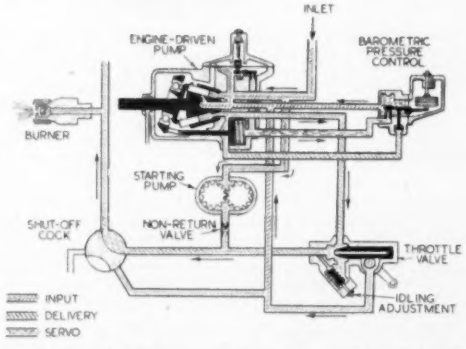


Fig. 2 (centre) Designed max. continuous power performance at altitude in I.C.A.N. conditions.

(Below) Schematic diagram of fuel system.



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trailing edge of the inner drum a spinner-like tailcone of sheet stainless steel is internally flange-bolted.

Having described the detail design of the engine, it remains now only to give some outline of the performance. The basic data are given in the accompanying curve, Fig. 1, which relates to sea level static performance in I.C.A.N. conditions, whilst Fig. 2 defines the altitude performance at maximum continuous power rating, i.e., with compressor r.p.m. at 97.5 per cent of maximum, and power turbine r.p.m. at 9,500. It is of point to note that these data were calculated on the basis of a 17-in diameter jet nozzle, and for the altitude cases an air intake efficiency of 90 per cent was assumed.

Emphasis must be given to the fact that these curves were evolved some little time ago, and relate to the designed performance; they are thus definitions of expectations. During the first runs of the engine, however, the following figures were obtained, both on the dynamometer and with the airscrew, and using a 20-in nozzle :—

Compressor r.p.m.	B.h.p.	Jet Thrust (lb)	Specific Consumption (lb/e.h.p/hr)	Jet Pipe Temperature (deg C)
11,000	2,630	620	0.62	430
11,500	3,350	770	0.58	455
12,000	4,100	920	0.55	485

It is patent that, on this showing, the original expectations tended toward the conservative. Certainly, it may be observed that the nozzle area differs, and by ringing the changes with nozzles the performance can be radically altered—so much so as to render the worth of specific figures questionable. In this instance, however, the matching of airscrew characteristics, engine performance and aircraft installation (i.e., in the Britannia) fixed the nozzle diameter at 17in, and the only reason a 20in nozzle was used for the initial engine runs was that, at ground level, it produces turbine outlet swirl conditions closely comparable to those given by a 17in nozzle at 35,000ft—the mean cruising height of the Britannia.

It has been made apparent in recent issues of *Flight* that, in the Britannia, the Bristol Aeroplane Company is producing an aircraft which will set new standards in commercial airline operating economy. It must be a source of considerable satisfaction to everyone at Filton that, if the initial runs are indicative of the future standard, the engines for this outstanding aircraft will, in fact, be even more efficient than was intended in their design.

C.B.B-W.

I.A.T.A. RADIO SYMPOSIUM

Representatives of Governments, Airlines and Industry Discuss Airborne Equipment

FOLLOWING the recent three-day symposium on airborne radio equipment convened in Copenhagen during the I.A.T.A. technical conference, the Association has issued a summary of the discussions, which is published here in somewhat abbreviated form. Though not to be considered as an official and final record of the proceedings, it does provide an interesting cross-section of opinions on an important aspect of civil air-transport equipment and an indication of future trends. Represented in the discussions, which were presided over by Mr. Edgar Post (superintendent of navigational aids, United Air Lines), were 20 airlines, 30 manufacturers, six other international organizations and agencies, the civil aviation department of seven states and the military air forces of three. It will be seen that the discussions are summarized in convenient question-and-answer form.

R/T Communications

To what extent can V.H.F. and/or U.H.F. meet the operational requirements for all aircraft communications?

There was no support for the idea that H.F. might be completely replaced by V.H.F. or U.H.F. for all aircraft communications. The use of V.H.F. over large water areas is considered to be impracticable at present. Complete dependence on V.H.F. over land is technically possible, but its use would to a large extent depend upon the economics of changing over as well as the availability of land lines in certain sparsely inhabited areas of the world. The feeling was expressed that a greater differentiation may eventually be made between air traffic control messages and other communications messages, and that there may be a corresponding diversion of equipment as well.

What are the effects of audio wave form distortion in R/T communications; what are the factors governing intelligibility; and what criteria can be developed to provide maximum intelligibility?

The crux of this question was the search for greater intelligibility of messages on present R/T. communications. A certain amount of built-in distortion is necessary and even desirable in order to make messages more understandable and to reduce the weight of airborne equipment, but there are no satisfactory methods of determining the safe limits of such distortion. Careful selection and limitation of the R/T. vocabulary was first advanced as a means of improvement. It was noted that, while a range between 200 and 6,200 cycles is necessary to cover all speech sounds, the top limit of this range can be reduced to between 2,500 and 3,200 cycles without too great a loss of understanding—so long as the transmission is devoted to a reasonably familiar subject. Cockpit noise, either entering into transmission through the microphone or obscuring reception through receivers, was held to be a major factor in limiting intelligibility. It was suggested that manufacturers might pay more attention to cockpit soundproofing. As an ideal situation, cockpit noise could be kept out of the microphone if pilots could use either mask or boom-type microphones, but neither of these was considered feasible for normal operations. There was wide agreement, however, that intelligibility could be substantially improved and the input of cockpit noise reduced if the R/T. speech practices of both flight crew and ground controllers could be improved. Attention was recommended for diction, voice placement and proper microphone positioning. An effective training method was said to be the recording of normal messages by personnel, who are then given an opportunity to hear their performance on a "play-back." "Speech clipping"—a form of modulation which reduces the limits of voice range in order to emphasize the more important speech sounds—was also stressed as a means of increasing the power of vocal transmission; R/T. should require as little deviation as possible from the normal voice level. Reception conditions would improve with the introduction of cockpit loudspeakers, but first of all there was a need for a quiet cockpit. Difficulties in maintaining the transmission qualities of both microphones and headsets were mentioned. Deterioration and variation of quality and performance was said to be much greater in carbon microphones than in the magnetic or dynamic type. It was felt that, of these last, the former have reached the limit of their capabilities and that future improvements were to be found with the latter.

How efficient from the viewpoint of band width as related to intelligence, and power as related to intelligence, are present R/T. communications?

It was recalled that the band width required for maximum intelligibility is from 300 to 6,200 cycles, and that this quality does not seriously drop when the top range is limited to 3,000. There is a rapid deterioration, however, if it is pushed below 2,400 cycles. An upper limit in the region of 3,000 cycles was therefore held to be sufficient for practical purposes. Manufacturers asserted that airlines should indicate to them the general environmental conditions in which they wish the equipment to operate, rather than specify exact band widths from the beginning. Overall power efficiency of airborne radio equipment was held to be low. In particular, low antenna efficiency is a drain on the whole system: with an ideal of 100 per cent, it presently varies from 2 to 20 per cent. Both manufacturers and airlines were urged to concentrate on improvements to present systems, which must in any case remain in use for some years, rather than to spend all of their effort on development of new systems and equipment items.

High Frequency

What are the true channel requirements for future H.F. airborne equipment (bearing in mind operational requirements, availability of frequencies, and techniques in equipment design)?

Generally speaking, the number of channels to be built into a piece of equipment was felt to provide no particular problem; difficulties were foreseen largely in complexities of control. It was felt that flexibility would be a fundamental requirement; while 10 channels might be adequate in an aircraft flying a single short route, as many as 100 channels would be necessary on longer routes. The view was expressed that it might be possible to begin with a comparatively simple form and add on groups of channels by a "building block" process. An indication of a possible upward limitation was found in the experience of the United States, where 144 to 156 frequencies are considered necessary for H.F. use. Several warnings were sounded that the forthcoming transition from presently-used frequencies to those allotted to air transportation will increase the need for flexibility in H.F. equipment, and that it might be advisable to provide extra channel space for as many as 200 frequencies during the transition period in view of the anticipated need to carry both old and new frequencies in certain cases.

What improvements are to be expected in D.S.B. H.F. communications by the introduction of new or improved techniques, for example, in antennæ and modulators, the use of space diversity systems, etc.?

Reports were presented on the results of experimentation with antennæ which make it possible to increase the efficiency of H.F. transmissions. These have included shorted wire or grounded antennæ, tail and wing cap antennæ, and open wire types.

While 85 per cent of transmissions from aircraft in flight are directed to stations fore and aft, signals which may be sent to ground stations to the port and starboard during the remainder of the time may be of vital importance and should be taken into account when aircraft antennæ are being designed.

Space diversity systems using two antennæ and receivers connected by an electronic switch are now being applied experimentally to aviation after having originated in point-to-point ground communications. Air-to-ground tests of the system indicate definite advantages for long-range R/T.

The elimination of radio noise between messages was considered desirable as a means of reducing pilot fatigue due to what was termed "continuous ear battering." It was considered that this might be obtained by selective signalling, the use of CODAN circuits and of "squelch" in high-frequency receivers. The latter means was held to be operationally simple, but technically difficult, because an additional pilot-operated control would probably be necessary. It was pointed out, however, that some American equipment now uses a coupled volume and sensitivity control, which seems to work effectively.

What would be the operational advantage of "single side band" (S.S.B.) over "double side band" (D.S.B.) in H.F. communications?

The S.S.B. system consists basically of transmission of messages on a carrier tone and one side band, rather than with the two side bands presently customary. A form of S.S.B. using a voice-suppressed carrier system is now under experimental test in Britain and was reported to have shown these advantages:—

(1) The large improvement of 9db. in signal strength.
(2) Better intelligibility in the face of interference.
(3) Almost complete absence of distortion due to selective fading.

Seen here during the Airborne Radio Equipment Symposium of the I.A.T.A. Technical Conference at Copenhagen are a group of representatives of various international organizations, including L. M. Layzell, R. C. Lowes and M. I. Forsythe-Grant of International Aeradio, Ltd.; R. P. Dutton, Collins Radio Corporation; L. W. D. Sharp, Plessey Co., Ltd.; H. T. Blaker, Pan American World Airways; J. G. Adam, B.E.A.; and C. P. Edwards, Ministry of Supply.

I.A.T.A. RADIO SYMPOSIUM . . .

(4) A halving of the probability of jamming by a single strong interference signal within the broadcast band.

(5) The ability to pack more channels into a given frequency space.

The disadvantages of S.S.B., as revealed so far, seem to lie in the necessity for accurate crystal control, using a close synchronizing tolerance of ± 300 cycles, as a matter of course; and the increasing complexity of the receiver due to the need for automatic frequency control.

Airborne equipment of S.S.B. would be generally equal in weight and bulk to that of D.S.B., would create a lighter drain on power supply, but have a slightly more complicated transmitter and receiver circuit. It was also pointed out that the S.S.B. ground receiver will accommodate D.S.B. reception as well without any alteration, but with some loss. French technicians suggested that a slight variation of the basic S.S.B., using an unsuppressed carrier, would eliminate some of the troubles stemming from the need to have very stable crystal-controlled radio carriers. While this would sacrifice a substantial amount of the theoretical advantage of S.S.B., it was said to be more adaptable to airline use, to make still closer cramming possible, and to improve intelligibility.

What would be the application problems associated with the introduction of S.S.B.?

To introduce S.S.B. to practical airline operations, it would first be necessary to have international agreement through I.C.A.O. on type specifications and to provide some sort of interim equipment which would accommodate both S.S.B. and D.S.B. It was not considered particularly difficult to provide the latter system. However, it was felt that the airlines are not yet ready to recommend any set type specifications to I.C.A.O., because they are not yet sufficiently certain of circumstances under which it must be applied, or of the relative importance of other proposed solutions. At the same time, one of the present pressing problems of the airlines is the blotting out of North Atlantic communications by magnetic storms, to which S.S.B. would be as susceptible.

V.H.F. and U.H.F.

What advantages can be derived from V.H.F./U.H.F. multi-carrier area coverage schemes, and what effects do such schemes have on airborne equipment design?

The British "Climax" system—developed on the basis of a Home Office system of police ground communication—is now in general operation for air activity over the south of England and Wales. The most advanced system now in use consists of five stations on one nominally common channel, each in fact separated by 10 kc/s. Two of these stations share a single frequency, so that, in practice, the five stations cover a range of 36 kc/s. The system employs conventional transmitters, but with especially high carrier frequency stability. The advantage of "Climax" in operational control was held to be its concentration on a single channel. In the aircraft, multi-carrier area coverage avoids the necessity for continuous change of channels by the pilot as the aircraft moves through the various phases of flight to termination. It was therefore held to reduce pilot fatigue and to achieve a considerable economy in the number of frequencies necessary to cover a given area, as compared with V.H.F. communication by individual channels.

Some American airlines which have experimented with variations on multi-carrier coverage since 1947 reported encouraging results and stated that they could confirm the need for frequency separations of the order of 10 kc/s as in the United Kingdom.

What are the true channel requirements for future V.H.F. equipments (bearing in mind operational requirements, availability of frequencies and techniques in equipment design)?

It was estimated that a seven-fold increase in channel requirements for future V.H.F. equipment could be forecast within the next eight years. The present maximum number recognized in any region by I.C.A.O. is 19, and the next increase is scheduled for 1953, when the number will be 31, plus 4 for operational control, making a total of 35. It was reckoned that the requirement would be 70 channels by 1956 and 140 channels by 1960. The development of equipment was felt to be keeping pace with the increase of demand. Nineteen to 50 channels are already accommodated in A.R.C. 1 equipment, as modified. Other equipment providing larger numbers of channels and already well on the way was discussed.

What operational advantages can be derived from "private line" communications and other selective and/or high capacity means of communications?

"Private line" in V.H.F. communications was defined as a system of automatic communications to provide a high percentage of routine communications for en route and terminal area traffic control messages, retaining a presentation of data in the aircraft until the air traffic control instruction is changed. As projected in the United States, it might use a special television technique with a high brilliance storage tube in the cockpit and which is capable of storing data in pictorial presentation for the intervals between transmission periods. To do its job properly, it was felt that "private line" must be backed up with a voice circuit for non-routine data not suitable for presentation on the pictorial display; and it was felt that such voice facilities might also be transmitted on V.O.R. and I.L.S. voice channels.

It was asserted that "private line" will make possible a greater utilization of communications channels, since it was held to be able to handle up to 60 aircraft on a given set of frequencies.

Presentation of Navigational Information

What studies have been made of the optimum system resolution of a visual presentation in the light of its cockpit location and the speed, frequency and accuracy with which observations must be made?

The basic cockpit space available to the instruments most used for in-flight and landing, it was said, is confined to a panel area about 11in deep and 22in wide. This follows from a requirement that the pilot needs a 20 deg angle of vision downward over the nose of his aircraft and from the fact that the depth of the space is limited by the height of the pilot's knees. Instruments to be concentrated within that space, it was felt, are A.S.I., machmeter, clock, attitude indicator, pitch, roll, azimuth, beacon angle, pressure height, radio height, rate of climb, approach information, slip, power and rate of turn. To cram this amount of instrumentation into 242 sq in, it was pointed out, requires the utmost possible ingenuity.

A determining factor in presenting information on these instruments is the degree of accuracy that is required in each case. A second factor is readability and lack of ambiguity; and, in the latter sense, it was warned that instruments using spiral scales, or one long and one short pointer, could be misread under conditions of stress. It was also considered undesirable to present on the same instrument data relating to things normally twinned in an aircraft: as an example, the inclusion of rev. counters for two engines on a single dial face has, on occasion, led to feathering the wrong engine.

It was recommended that markings on the face of instruments be held to the absolute minimum necessary to give information and that non-linear scales should be avoided; and that, for optimum interpolation, the angular distance between markings should be 5 deg.

It was stressed that information should be displayed in the expected sense and that, because virtually all personnel are conditioned to clock reading, all instrument values should increase in a clockwise direction. At the same time, when an indicator is displaced from its zero by an alteration in aircraft attitude, it should be put back by an operation of the control which works in the same sense. The grouping of information is limited, to some extent, by the fact that the cone of attention of the eye—within which each pointer movement can be noted without eye movement—is approximately 8 deg.

To what extent is the increasing multiplicity of indications likely to cause confusion and so prevent full appreciation of the available information? (By multiplicity of indications is meant the use of indicators performing more than one function, instruments combining information on one unit from various sources, the integration of information from various sources into one presentation, and the availability of the same information on more than one instrument.)

Pilots participating in the symposium asserted that their requirements could best be met if engineers gave them the illusion of actual visual flight, so that there would be no change of concept between instrument and visual flight conditions. At the same time, they pointed out that the pilot does not have a great deal of time for comparing and figuring, and that they therefore prefer instruments which can be glanced at rather than those which must be read. It was stated that different presentation patterns are demanded for various purposes, such as direction finding, tracking, instrument approach, and the like. Instrumentation, it was said, has two purposes—to aid the pilot in doing what he should do, and to monitor him in the process. These are not entirely compatible and, it was felt, can never be entirely reconciled.

The principal effect of multiple indication in instruments is to render the coupling between navigation aids and aircraft performance semi-automatic and less dependent on the exertions of the pilot himself. The suggestion was made that it might be advisable to make the co-pilot the coupling agent actually handling the controls according to the communications given him by instruments, and to have the pilot act as the monitor. However, airlines actually using multiple instruments such as the Zero Reader, asserted that the new instrumentation has relieved the pilot to the point where he can act as the coupler himself and still do a better monitoring job.

What are the relative merits of pictorial, graphic, and instrument (symbolic through dials, needles, etc.) presentations, either in general or for specific applications?

This discussion drew to a large extent on the answers to the preceding questions as regards instrument presentations already in use, and introduction of new material centered largely on pictorial presentation. It was pointed out that, while one type of pictorial presentation instrument, based on V.O.R. and D.M.E., has been put to limited experimental use, general international application is still a matter for long-term consideration because there is no satisfactory airborne D.M.E. for international use at the present time. It was pointed out that many pictorial presentations make it hard for the pilot to discriminate within limits closer than one-half mile, due to the physical limitations of the picture. This fact, it was suggested, might hold pictorial instruments to a purely monitoring function.

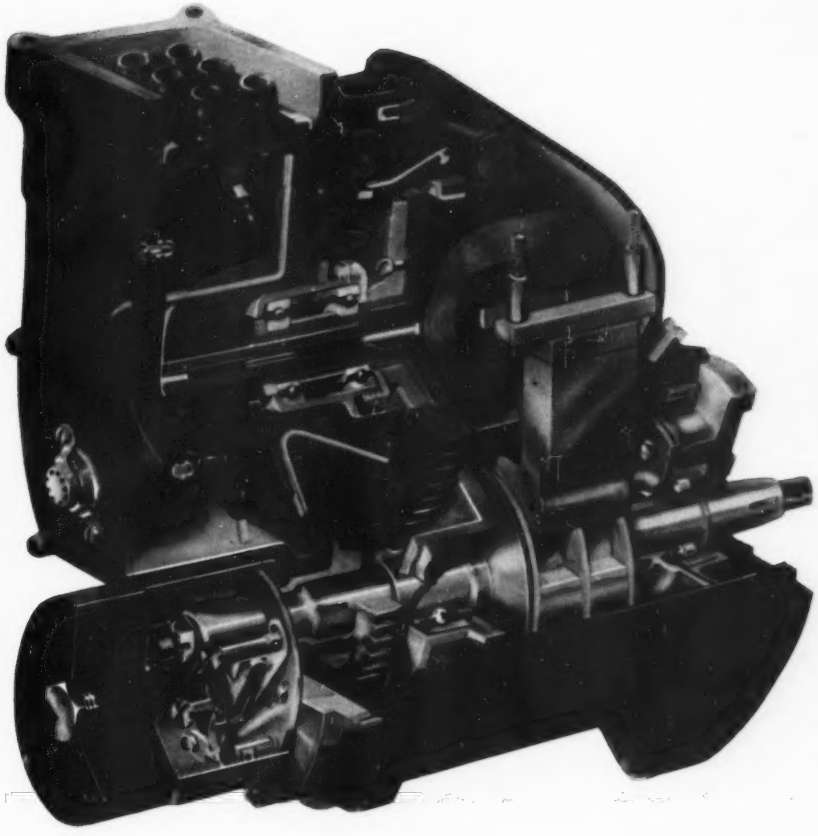
It was noted that the amount of data presented in any kind of composite pictorial display should be limited strictly to that actually needed. Experience with cockpit lighting indicated that black and grey colouring may be the most clear and effective for pictorial presentation in view of the general use of red cockpit lighting. Pictorial presentation, in facsimile or other similar form, may possibly have an application to communications as well as to navigation.

Antenna Installation Problems

To what extent can aircraft antenna requirements be standardized to permit their incorporation in all new aircraft at the initial design stage?

The use of suppressed antennæ makes the incorporation of antenna requirements in all new aircraft at the initial design stage of major importance. Suppressed "package" antennæ have so far been developed successfully for glide slope, marker beacon (75 mc/s), radio altimeter (400 mc/s), V.O.R., and low-frequency equipment. Suppressed H.F. antennæ have been a somewhat greater problem. H.F. antennæ have been embedded in aileron areas and main fuselage sections, as well as in isolated tail sections, with considerable success.

The suggestion was advanced that, if antenna matching units employing valves were mounted in the fuselage, considerable maintenance difficulty would result. It was also felt that these valves, if mounted in the tail, might be affected by vibration unless entirely new mounting techniques were to be used.



Rotax 12-cylinder engine magneto

Progressively developed from the original magnetos used on the Hurricanes and Spitfires, the latest version of these famous magnetos is now standard equipment on the Rolls Royce " Merlin " reciprocating engines used by :

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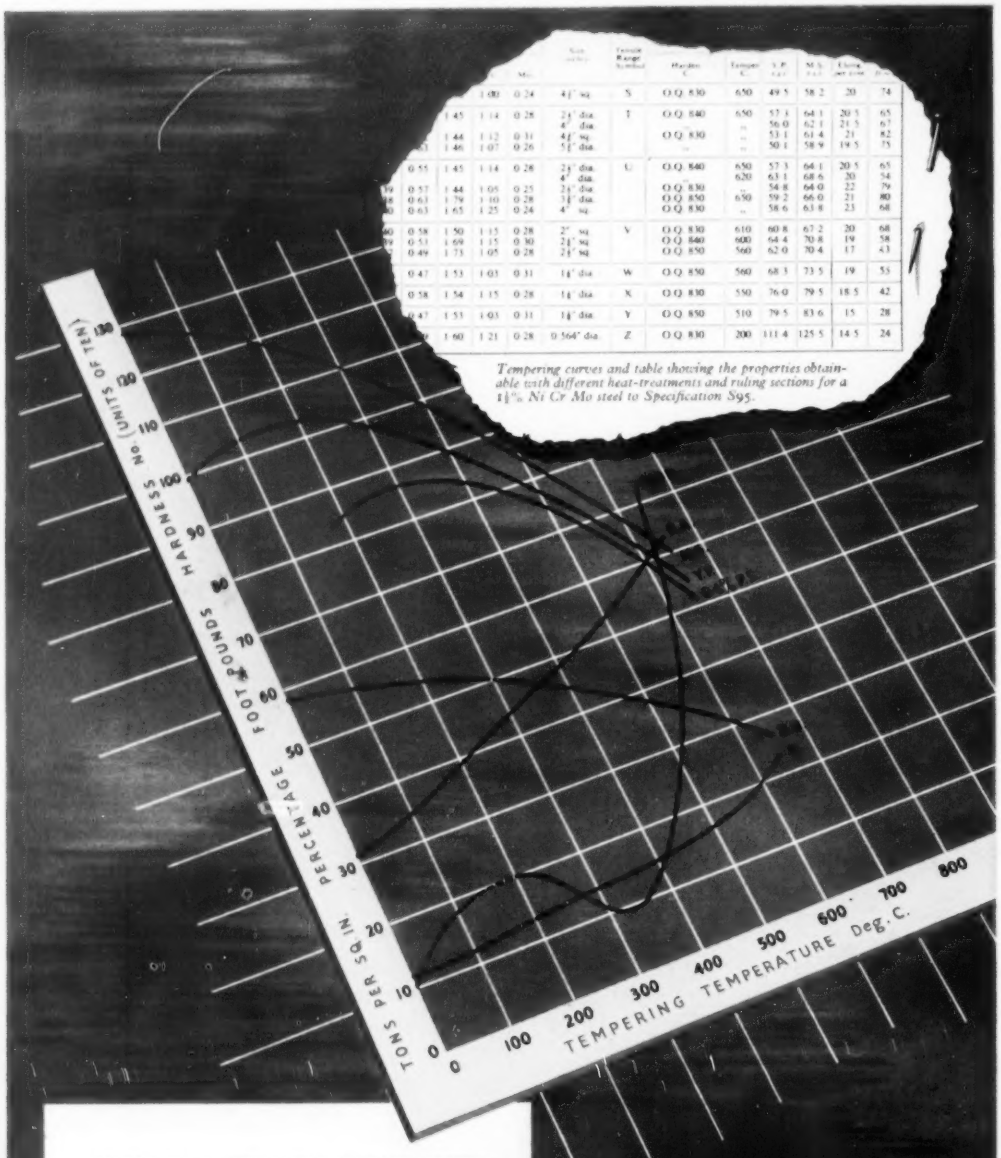
	Mn.		Tensile Range Symbol	Hardening °C.	Temper °C.	Y.P. tons/sq.in.	M.S. tons/sq.in.	Elong. on 2 in. %	R of A %
1·00	0·24	4″ sq.	S	O.Q. 830	650	49·5	58·2	20	74
1·45	1·14	0·25	2½″ dia.	T	O.Q. 840	650	57·1	64·1	20·5	65
			4″ dia.				56·0	62·1	21·5	67
1·44	1·12	0·31	4″ sq.		O.Q. 830	,,	53·1	61·4	21	82
1·46	1·07	0·26	5½″ dia.		,,	,,	50·1	58·9	19·5	75
0·55	1·45	1·14	0·28	2½″ dia.	U	O.Q. 840	650	57·3	64·1	20·5	65
				4″ dia.			620	63·1	68·6	20	54
0·57	1·44	1·05	0·25	2½″ dia.		O.Q. 830	,,	54·8	64·0	22	79
0·63	1·79	1·10	0·28	3½″ dia.		O.Q. 850	650	59·2	66·0	21	80
0·63	1·65	1·25	0·24	4″ sq.		O.Q. 830	,,	58·6	63·8	23	68
0·58	1·50	1·15	0·28	2″ sq.	V	O.Q. 830	610	60·8	67·2	20	68
0·53	1·69	1·15	0·30	2½″ sq.		O.Q. 840	600	64·4	70·8	19	58
0·49	1·73	1·05	0·28	2½″ sq.		O.Q. 850	560	62·0	70·4	17	43
0·47	1·53	1·03	0·31	1½″ dia.	W	O.Q. 850	560	68·3	73·5	19	55
0·58	1·54	1·15	0·28	1½″ dia.	X	O.Q. 830	550	76·0	79·5	18·5	42
0·47	1·53	1·03	0·31	1½″ dia.	Y	O.Q. 850	510	79·5	83·6	15	28
1·60	1·21	0·28	0·564″ dia.	Z	O.Q. 830	200	111·4	125·5	14·5	24

Tempering curves and table showing the properties obtainable with different heat-treatments and ruling sections for a 1¼% Ni Cr Mo steel to Specification S95.



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I.A.T.A. RADIO SYMPOSIUM . . .

Where is the economic balance between the efforts expended in the reduction of drag of antennas and the benefits realised, in the various airspeed groups?

It was felt that wire aerials were expensive to maintain, but relatively cheap to install. Suppressed aerials, on the other hand, if introduced early enough into the original aircraft design, might cut the cost of installation, and adequate care in design might operate to keep maintenance costs low. Other advantages of suppressed aerials were said to be low drag, improvement in appearance, and relative freedom from icing.

The optimum desirable airspeed group to which suppressed antennae might be applied was felt to start at about 250 miles per hour.

To what extent has experience shown that the operational performance of various radio systems is affected when their associated antennas are drag-free?

Suppressed antennae already in use were felt to give results equally as good as those of the outside type at the present time, and to have greater potentialities for improvement.

Although pick-up is slightly less with suppression, it was felt that this has been compensated for by improved design techniques.

In the case of 1,000 mc/s, there has been some difficulty in getting desired radiation patterns, but little operational data has been collected on results obtained so far. It was felt, however, that this possible trouble might have to be overcome by using diversity antennae.

What have been the results of drag reduction developments as regard corona losses and precipitation static characteristics?

Little information was said to be available as yet on either of these points. It was felt, however, that corona discharge presented no difficulty provided that the antenna was adequately matched to its associated transmitter. In general this was possible, and lower peak voltages at the antenna resulted.

Equipment Design and Installation

What is the justification for continuing the practice of having most radio installations specified by the airline?

One manufacturer pointed out that in the case of a single type of aircraft, orders from 27 airlines had specified 21 different radio installations and that the difference in cost between the basic system provided and the most expensive special equipment ordered was £60,000 per aircraft. The airlines pointed out that some reason for divergence was to be found in the desire of an airline to maintain standardization within its own fleet, and they warned against standardization to a degree which might stultify progress. There was, however, general agreement that it was advisable to shrink the area of divergence as much and as soon as possible.

What are the advantages of complete A.C. operation of radio equipment in aircraft?

Complete A.C. operation was held to offer the advantages of eliminating much rotating machinery (such as inverters), increasing reliability, and reducing weight. However, it was pointed out that D.C. supplies would always remain a requirement to some extent, not only for certain special functions, but also to meet such requirements as emergency operation of the radio.

What is the economic significance of airborne equipment weight and size, and to what extent is a reduction of the weight and size of airborne radio equipment practicable?

While it has been generally considered that the overall operating cost per pound of airborne radio equipment was high, Dutch studies produced in the symposium indicated that the initial cost of equipment is comparatively low and that the real expense is incurred in maintenance. It was therefore felt that simplicity and reliability of equipment were more important targets than weight and space saving. Miniaturization should not be carried too far, because it can increase maintenance difficulties and so reduce reliability.

What is the desirability of combining in one unit those airborne systems that have operational and technical features in common?

Each case of combination, it was felt, must be considered on its own merits. In some instances, the process offers valuable extension of facilities at very little increase in cost or complexity; but in others, additional complications of equipment as a result of combining systems would be out of proportion to the operational advantage gained. It was shown that the addition of a voice channel to V.O.R. I.L.S. costs very little, but does increase the difficulty of obtaining wide band operation and increases the complication of antenna switching.

Miscellaneous

What are the developments to date in the field of radar transponders?

An outgrowth of the wartime I.F.F. (identification of friend or foe), radar transponders have been developed to improve the effectiveness of radar in handling air traffic control, to afford greater range at lower cost, greater protection against clutter, and to eliminate time-consuming procedure turns or other means of identifying an aircraft in the radar scope. There was some discussion of the merit of making radar transponders provide many discrete, or separate, codes, to provide more than one function and to add other features such as height coding, but it was felt that any such action would delay the availability of transponders for operations by many years.

What are the merits and possibilities of airborne performance monitoring of communications and navigation equipment?

In some systems, notably in communications, the checking feature is usually satisfactory. In others, such as the marker beacon system, however, there is now no way by which the pilot can be absolutely certain whether his equipment is in order, and an airborne monitoring system would therefore be valuable in such cases.

Other Subjects

Major attention was given to data on the results of experimentation with terminal V.O.R. as an economical short-distance navigation aid which, through simplified design, may meet the V.O.R. requirement in less highly developed areas.

Development of terminal V.O.R. was started one year ago in the U.S. with equipment largely put together from available standard radio items. It is, however, notable for a new and less complicated cylindrical slot antenna which avoids much of the setting-up complications and results in only a very small cone of confusion. It was reported that ground station errors on terminal V.O.R. have so far been held to less than one degree and overall station errors to ± 2 deg. It has a proven range of 40 miles at 1,500ft, 90 miles at 5,000ft, and an estimated range of 120-130 miles at 12,000ft. Estimated cost on a manufactured basis, including a Wilcox 50-watt transmitter and a housing, was said to be in the neighbourhood of $7,500.

FORTHCOMING EVENTS

June
4-14. Third Mechanical Handling Exhibition, Olympia, London.
June 6-8. Aéro Club d'Italia: Air Circuit of Sicily.
June 7. A.T.A. Association: Flag Dedication, and Reunion, White Waltham.
June 7-8. Yorkshire Aeroplane Club: International Invitation Rally, Sherburn-in-Elmet.
June 8. Royal Naval Flying Club: At Home, R.N. Air Station, Gosport.
June 8. R.A.F. Golfing Society: Match v Air Ministry G.S.
June 14. Girl Guides Association: Air Ranger Flying Pageant, Sywell, Northampton.
June 14. Auster Flying Club: Rally, Rearsby.
June 14. R.A.F.A.: Air Pageant, Sydenham, Belfast.
June 14. London Aeroplane Club, Vintage Aeroplane Club and Herts Auto and Aero Club: At Home, Panshanger.
June 14. Fair Oaks Flying Club, R.A.F.V.R., and London Transport Flying Club: At Home and Display, Fair Oaks.
June
14-15. Wines and Chateaux of Anjou Rally, Angers.
June
14-15. Aéro-Club de Charente Maritime: Pons Rally.
June 15. R.Ae.S. Garden Party, White Waltham.
June 18. Aircraft Recognition Society: Contest, London.
June 21. Boston Aero Club: Display.
June
21-22. Aéro-Club de Basse Normandie: Flers Rally.
June 22. Aéro-Club de Savoie: Aix-les-Bains Rally.
June 24. Golf: R.N. v. R.A.F., Sandwich.
June 25. Golf: R.A.F. v Army, Sandwich.
June 27. London Aeroplane Club: Midsummer Dance, Hatfield.
June 28. R.N. Air Station Eglington: Air Day.
June
28-29. Aéro-Club d'Eure et Loire: Rally, Chartres.
June
28-29. R.Ae.C.: La Baule Rally.
June 29. Northern Heights Model Flying Club: Gala Day, Hawker Airfield, Langley.
June 30-
July 13. International Gliding Contests, Spain.
July 4-7. Aéro-Club de Belgique: Control-line Models World Championships, Melsbroek, Brussels.
July 5-6. Aéro-Club de Touraine: Wines Rally.
July 5-7. R.Ae.C.: Deauville Rally.
July 6. Aéro-Club d'Auvergne: International Air Meeting.
July 6-13. Ailes Ardennaises: Air Fête.
July
10-14. Wakefield Cup Models Contest, Norrkoping, Sweden.
July
11-12. National Air Races, Newcastle-on-Tyne Municipal Airport.
July 19. Leicestershire Aero Club: Rally, Leicester East.
July
20-27. Aéro Club d'Italia: International Air Week, Italy.
July 24. Royal Engineers' Flying Club: Air Day, Rochester.
July 27. R.A.F. Golfing Society: Match v. 2nd T.A.F., Bad Eilsen.
Aug. 2. "Daily Express" Challenge Trophy Race.
Aug. 2-3. "ILSY" Air Display, Ypenburg.
Aug. 3-4. S.M.A.E.: National Model Flying Contest, R.N. Air Station, Gosport.
Aug.
9-10. Skegness Airport: Display.
Aug. 15. Aéro-Club de Charente Maritime: Laleu and La Rochelle Air Meeting.
Aug. 15. Ailes Montluconnaises: Rally.
Aug. 16. Aéro-Club de Vendée: Sables d'Olonne Rally.
Aug.
16-17. Bembridge and Sandown Aero Club: Rally.
Aug. 23. Coventry Aeroplane Club: Air Day and Siddeley Challenge Trophy Race.
Aug.
23-24. Aéro-Club de Trente: Dolomites Circuit.
Aug. 30. Midland Aero Club: Display.
Aug.
30-31. U.S. National Air Races.
Aug. 31. A.B.A.C.: Summer Convention.
Aug. 31-
Sept. 7. Scandinavian Air Rally.
Sept. 7. S.M.A.E. Yorkshire Evening News Model Flying Festival, Sherburn-in-Elmet.
Sept.1-7. S.B.A.C.: Flying Display and Exhibition, Farnborough.
Sept. 15. Battle of Britain Day.
Sept. 15. I.A.T.A.: Eighth Annual General Meeting, Germany.
Sept. 17. Golf: R.N. and W.R.N.S. v. R.A.F. and W.R.A.F., Camberley.
Sept. 20. R.A.F. At Home Day.
Sept. 28. Aéro Club de France: Coupe Stemm Helicopter Competition.

CIVIL AVIATION

BUSINESS BEGINS at the fifth I.A.T.A. technical conference as Capt. J. C. Kelly-Rogers, assistant general manager of Aer Lingus and chairman of the I.A.T.A. Technical Committee, raps the table. With him in this view are (left to right) G. Teisen, Danish C.A.A.; Per Kampmann, chairman, S.A.S.; Knud Ree, Acting Minister, Danish Ministry of Public Works; Sir William Hildred, director-general, I.A.T.A.; and Palle Christensen, Secretary of State, Danish Ministry of Public Works. The Conference was held at Copenhagen.

THE NEW GOVERNMENT POLICY: INDEPENDENTS DISAPPOINTED

MANY current questions, particularly on the subject of United Kingdom internal routes, were only partly answered when the Minister of Transport and Civil Aviation, Mr. A. T. Lennox-Boyd, made his eagerly awaited statement on air-transport policy in the House of Commons on May 27th. The Minister (who had been in office only two weeks) made it clear, however, that he wished to indicate as soon as possible the fields of opportunity open to private operators and to dispel rumours as to the expected changes in policy. These changes, he said, were designed to "tilt the emphasis on greater competition in the air . . . the maximum competition consistent with our broad national interests."

Briefly, the opportunities promised to independent operators last month by the former Minister, Mr. Maclay, will be as follows: (i) Associate agreements will normally be granted for periods of seven years (ten in special cases) to give the security required for acquisition and outlay of capital; (ii) development of new overseas scheduled services not forming part of the Corporations' existing networks will be open to the Corporations and independent operators alike; (iii) development of all-freight services anywhere in the world; (iv) cut-rate inclusive tours and other special services not directly competitive with the Corporations to places within the Colonial Empire.

The Minister added that charter operations would be undertaken by the Corporations only when they had special facilities—so that trade would not be lost to foreign competition; they would not maintain aircraft specifically for charter work. Earlier he had made it clear that the Corporations were regarded as important earners of foreign currency and that their "competitive strength . . . to operate first and second or tourist-class services" would not be impaired.

On the important question of internal scheduled routes, Mr. Lennox-Boyd was less specific: he said that his Ministry was still examining the best way of dealing with this special problem. Meanwhile, B.E.A. would continue to operate their existing network and additional services would be made available to private operators for long-term periods. The private services would continue to be run in association with the Corporations under licence from the Air Transport Advisory Council.

The powers of the Council would be increased as far as was possible under the legal limitations of the Civil Aviation Act of 1949. In its new form, A.T.A.C. would be operating by July; it would be reconstituted and would sit in more formal fashion. The Council's first task was to give greater security of tenure to companies operating the existing associate services, and its second, to consider applications to open new services anywhere in the world outside the Corporation networks. Ministerial approval would continue to be necessary, but Mr. Lennox-Boyd indicated that his over-riding powers were unlikely to be used. Although he would prefer to see a completely independent licensing authority on the lines of the American C.A.B., the Minister said that to establish one would involve a change of law—a procedure at present to be avoided if possible. But if the policy proved unworkable under the existing legal machinery, the law would have to be changed. Terms of service granted by the reconstituted A.T.A.C. would have to be not less favourable than those reached through the National Joint Council for Civil Air Transport.

Considerable interest was aroused by the statement both in the Lords (where it was read by Lord Leathers) and the Commons. The policy was immediately attacked by Opposition speakers (Lord Pakenham said it threatened the international activities of the Corporations and held a vague menace over their internal activities as well; Mr. Herbert Morrison described it as a "spanner in the works," and debates were requested in both Houses. Among the more pertinent supplementary questions was that of Mr. Grimond (Lab., Orkney and Shetland), who asked whether the Minister had considered the need for helicopter services; Mr. Lennox-Boyd replied that they would not be included in any contract under the new proposed licensing agency and that there would be full freedom to develop helicopter services as seemed best in the light of modern knowledge and the needs of every locality.

Although Mr. Lennox-Boyd's statement referred only in general terms to the internal services, these have obviously been—and still are—under active discussion. It seems that the independent operators were invited to take over practically the entire U.K. network—with the exceptions of the London-Glasgow and London-Belfast routes, which would remain in the hands of B.E.A. Operators would receive no subsidies except on the Scottish "social service" routes. Since some 50 per cent of B.E.A.'s revenue on internal routes was derived from the Belfast and Glasgow services the independents were unwilling to take over the remaining services.

This point has been strongly brought out by Mr. Eric Rylands (Lancashire Aircraft Corporation), chairman of B.I.A.T.A., in a statement expressing the Association's "profound disappointment that the door to development of British air transport is to be left little more than ajar."

While welcoming the Minister's intentions to set up a licensing authority on lines similar to the C.A.B., Mr. Rylands protests against the exclusion from the purview of that authority of the only routes upon which an economic system could be built up. He further criticises the Government's continuation of the "Socialist policy of wet-nursing the Corporations." He says that the independents are, in fact, getting very few new opportunities: "The independent operators are invited to raise private capital, at double the interest paid by the Corporations, whose capital is Government guaranteed; the independent operators are invited to operate international freight services on those routes which the Corporations have not considered sufficiently profitable to justify putting on services themselves; the independent operators are invited to operate on Colonial routes third-class passenger services on which Corporation participation will not be denied." Members of B.I.A.T.A., he concludes, will accept the crumbs given them by the present Government and, while exploring this meagre opportunity to the full, will continue to press the Government until the door to full expansion of British air transport is forced, or thrown, wide open.

REDUCING AIR-CARGO FORMALITIES

IN reporting the results of the air-cargo documentation survey, by the I.A.T.A. Facilitation Office, Sir William Hildred, director-general of I.A.T.A., declares that "considering the mass of red tape through which we had to fly air cargo in the years immediately after the war, the present situation is the most favourable the airlines have ever known. . . . Nevertheless, we can consider that we are only one-third of the way towards our goal, which is to see air-cargo shipments move anywhere in the world on the commercial invoice alone and without consular formalities." I.A.T.A. states that documents generally considered unnecessary by the airlines are import licences, consular invoices, copies of the airliners' air waybills and such papers as certificates of origin. Now accepted in 54 countries, the international cargo invoice is recommended as the standard single cargo document by I.C.A.O. (which, with I.A.T.A., is attacking the red-tape problem.)

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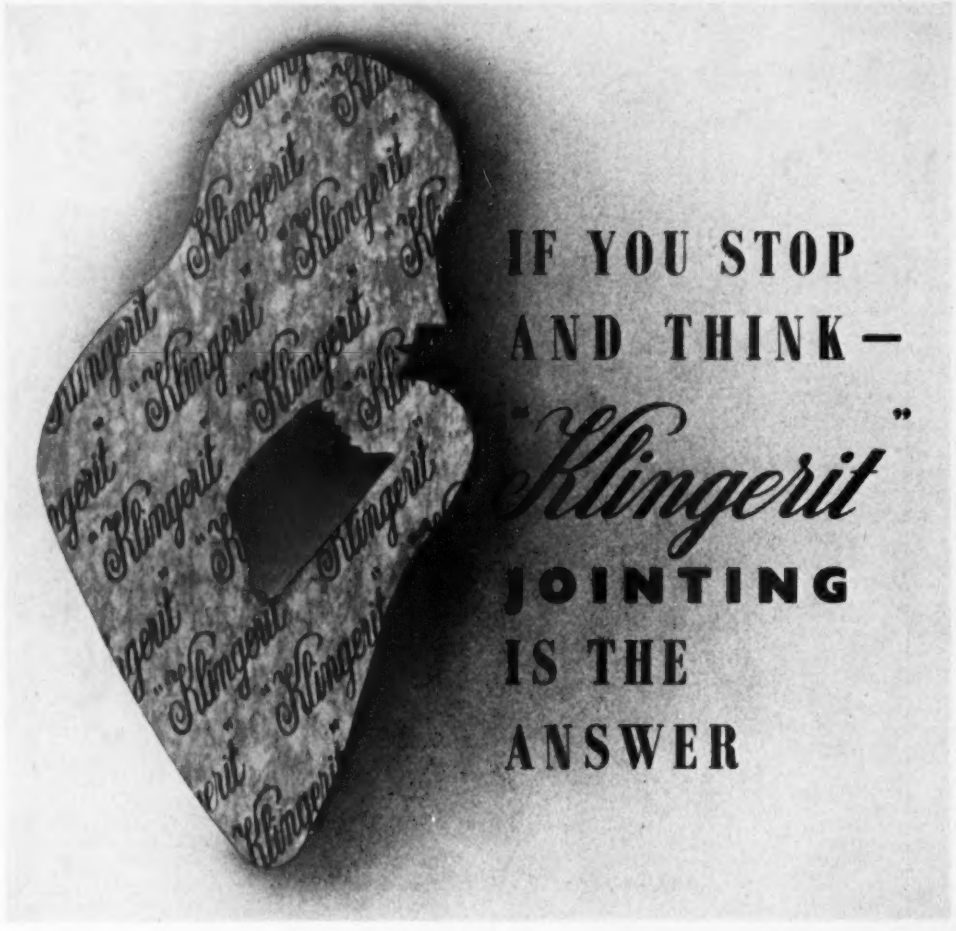

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CIVIL AVIATION . . .

BYRRH-SELLER: Emblazoned with the name of a famous French aperitif, this highly decorative D.H. Rapide has just left the Croydon works of W. A. Rollason, Ltd., where it was completely re-upholstered, equipped with Marconi 87-8882 with loop and T.R.1430 V.H.F. and repainted in white, pillar-box red and royal blue. Throughout this year it will give "baptême de l'air" flights all over France.

QANTAS JOHANNESBURG SERVICE

CONSTELLATION 749As carrying 38 passengers will be used on the fortnightly Qantas service from Sydney to Johannesburg *via* Perth, the Cocos Islands and Mauritius, due to start on September 1st. The first flight in a return direction will begin on September 4th. Estimated elapsed time for the journey will be 3½ days in each direction; fares will be £A275 single and £A495 return. A proving flight carrying Qantas and Government officials is expected to leave Sydney on July 25th.

The work of re-establishing the Cocos as a refuelling point is being undertaken by an R.A.A.F. construction unit and the Australian Department of Civil Aviation at a cost of £A700,000.

LIFTMASTERS FOR PANAM

THREE Douglas DC-6A Liftmaster pressurized freighters have been ordered by Pan American World Airways following the company's recent increase in cargo traffic on both Atlantic and Latin-American routes. The DC-6A, costing over $1m and due for delivery in 1954, will bring to 42 the total of DC-6 type aircraft ordered by Pan American. They will each carry a payload of 25,000 lb at a cruising speed of over 300 m.p.h. Basically similar to the DC-6B, the cargo version has large upward-hinging doors both fore and aft of the wings; fuselage capacity is 5,000 cu.ft.

COMET FREQUENCIES INCREASED

FROM Sunday, June 1st, B.O.A.C. increased the frequency of its Comet services between London and Johannesburg from one to three a week in each direction. Comets now leave London Airport at 1500 hr on Tuesdays, Fridays, and Sundays, and departures from Johannesburg are at 0900 hr (local time) on Mondays, Wednesdays, and Fridays. Hermes services between the two capitals *via* the west coast of Africa were discontinued on June 1st and the B.O.A.C. establishment at Brazzaville, through which they have been operated, was closed down. On the same day the Corporation introduced a new system of Hermes services between London and West Africa. Previously there were daily services in each direction on the route London-Tripoli-Kano-Lagos-Accra; new there are four flights weekly each way between London and Lagos and three between London and Accra, both services making intermediate stops at Tripoli and Kano. Total journey-time between London and Lagos is 18 hr 40 min and the Accra service takes 45 min longer. There are also seven weekly Hermes services between London and Nairobi in each direction.

BRETAGNES THROUGH BRITAIN

INTEREST in the French S.O. 30 Bretagne twin-engined 30-43 passenger transport has been increased by the news that Aerocontacts, Ltd., have been appointed British Commonwealth concessionaires for the aircraft. The company's overseas representative, W/C. P. T. Wilby, reports after flying the aircraft that he was greatly impressed by its handling qualities and general performance.

Aerocontacts intend to press the sales of the Bretagne throughout the Commonwealth and in certain foreign countries; they are confident of success, pointing out the very short delivery date of six months now being quoted by S.N.C.A.S.O. and the favourable price (probably in the region of £150,000) compared with other transports of a similar specification. Cruising speed of the Mk 2 Bretagne (2 P. and W. R-2800 CA-18) is quoted as over 260 m.p.h. on 1,100 h.p. per engine at 19,500 ft.

FUEL RESTRICTIONS RELAXED

IT was announced on May 28th that the amount of fuel allowable to United Kingdom operators of civil aircraft during the period May 12th to June 9th was to be increased by 20 per cent following the return of workers to most of the U.S. oil refineries. Previously, operators had been drawing 65 per cent of supplies made in April; the effect of the relaxation was to increase this proportion to 78 per cent.

Now that the shortage has passed its peak, operators are beginning to resume services, but some restrictions are likely to continue well after June 9th. Both B.O.A.C. and B.E.A. have re-started some of their cancelled services, but the latter Corporation's new "Silver Wing" London-Paris luxury service will be inaugurated on June 16th instead of on June 9th as originally planned.

Silver City Airways, whose Lympne-Le Touquet car ferry has not been affected by the fuel restrictions, announced the cancellation of their Tourist Trophy car and cycle ferry from Blackpool to the Isle of Man, which was due to start on June 7th.

CHIEF EXECUTIVE'S CHORES

EXPLAINING why he is tied down to a desk too much for his liking, Mr. Peter Masefield lists in the *B.E.A. Magazine* some of the papers accumulating in his "in" tray—and gives an unusually revealing insight into the complex problems besetting the modern airline executive. "Taken at random," he writes, "The subjects to be dealt with, or discussed with those concerned, include: Budget 1952-53, flight-simulator problems, Elizabethan delivery programme, helicopter-base arrangements, annual report 1951-52, Decca Navigator policy, London Airport and Gatwick development for B.E.A., policy of charging for surface transport, tourist-Viking conversions, possible economies, freighter policy, staff suggestions, bilateral agreements for traffic rights in foreign countries, winter schedules and longer-term plans, new routes, tourist-class fares, staff numbers, route costs, airport gate system, associate agreements, welfare arrangements, future aircraft requirements, National Joint Council meetings, etc."

Soon after those words were written, of course, an additional and even more urgent problem arrived in the shape of the fuel crisis, which affected B.E.A.'s services very drastically. But, however great the temptation, it seems unlikely that B.E.A.'s chief executive will resort to the office-tactics practised by one war-time wing commander of our acquaintance, who had a fourth desk-tray to supplement the usual "In", "Out" and "Pending": it was labelled "Too Difficult."

BREVITIES

TOTAL commercial sales of the Douglas DC-6 transport have reached 354 (including 159 of the latest DC-6B variants) following the recently announced decision of Scandinavian Airlines to increase its order from eight to 14 DC-6Bs. The first order is being realized this month but the additional eight are not due for delivery for some 16-20 months; they will be used for reduced-fare services on the North Atlantic route.

* * *

Air transport movements recorded at U.K. airports in April, 1952, totalled 14,116, 12.2 per cent more than in the corresponding period for 1951. Passengers handled totalled 199,850, an increase of 17.9 per cent on the figure for April 1951. The amount of freight on- and off-loaded, 3,244 short tons, showed a decrease of 11.4 per cent.

* * *

The British Travel and Holidays Association reports that 51,500 visitors arrived from abroad in April, an increase of 5 per cent on last year's April figure and 45 per cent more than the pre-war average for the month. Among them were 9,900 Americans and 14,600 visitors from the Commonwealth.

* * *

Although Aer Lingus do not expect delivery of the last of their Mk 31E Bristol 170 Wayfarers until September, they have already been allocated names and registrations for all four aircraft; they are to be *St Finbar*, EI-AFQ; *St Ronan*, EI-AFR; *St Senan*, EI-AFS; and *St Flannan*, EI-AFT.

* * *

Recent sporting events have meant extra work for the freighters of Silver City Airways. Twenty French racehorses were flown across the Channel during Derby week, including the eight which took part in the classic race. Better sporting luck, it is hoped, will follow the flights from Toulouse to Belfast of two B.R.M. racing cars, and from Lympne to Le Touquet of the Aston Martin DB3s which will compete in the 24-hour Le Mans race.

CIVIL AVIATION . . .

should be made ready for Comet services later this year. The recommendations include the building of a third runway, the provision of adequate ground and air navigational aids, and the improvement of buildings, roads and other facilities.

* * *

As part of its long-range expansion programme, United Air Lines are planning to order ten more Convair 340s and are negotiating for the purchase of 25 four-engined transports of unstated make. Approximately $56,000,000 is involved.

* * *

To meet a steadily increasing demand from tourists, the Tasman Empire Airways "Coral Route" service from Auckland to Tahiti will have its frequency increased during the coming local-winter season. From last week, fortnightly services (instead of monthly) will operate between Suva, Aitutaki and Papeete and the Auckland-Suva services will be increased from one-weekly to three fortnightly.

A survey of the need for trained personnel to provide aviation ground services in the countries of the Caribbean area has been carried out by I.C.A.O. and World Meteorological Organization technicians, working as part of the United Nations Expanded Programme for Technical Assistance. During the next 18 months ground services in the area will require the training of some 1,600 persons.

* * *

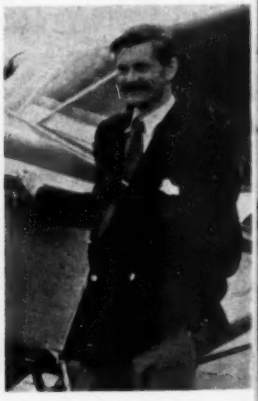
The Ministry of Civil Aviation announces the appointment of Mr. Wilfred Gawthorne as Civil Air Adviser to the Commissioner-General, South-East Asia, and Civil Air Attaché for Siam, the Philippines and Vietnam. He will leave the United Kingdom on Friday, June 27th, and will be based at Singapore. Mr. Gawthorne joined the M.C.A. in 1946 and for the past three years has been employed on administrative duties connected with ground facilities on trunk air-routes east of Cairo.

R.Ae.C. AVIATORS' CERTIFICATES

WE publish below another of the periodical lists of those who have qualified for Royal Aero Club Aviators' Certificates. The previous list, from No. 27,879 to No. 27,941, appeared in *Flight* of May 23rd. The names which follow are part of what will be the final list in the present series, for the certificates are no longer a necessary qualification for obtaining a P.P.L. The remainder of the final batch of names will be published in a forthcoming issue. After that, the lists are likely to be short ones, containing the names of those who still, from personal choice, apply for, and are granted, certificates.

No.	Name	Club or School	Date
27,942	J. Worrall	Qualified Service pilot	16.2.52
27,943	A. G. Hamon	R.A.F. Syerston	16.2.52
27,944	H. Madoc-Jones	" " "	16.2.52
27,945	H. S. Hamilton	" " "	16.2.52
27,946	R. A. Fox-Linton	" " "	16.2.52
27,947	P. J. Thrower	Oakington	16.2.52
27,948	A. C. Small	" "	16.2.52
27,949	K. E. Foster	" "	16.2.52
27,950	G. J. D. Walton	Elstree Flying School	16.2.52
27,951	G. L. Brice	Qualified Service pilot	16.2.52
27,952	R. B. Lines	" "	22.2.52
27,953	M. Waight	R.A.F. Cottesmore	22.2.52
27,954	J. W. Still	Qualified Service pilot	22.2.52
27,955	A. A. Bough	Newcastle Aero Club	22.2.52
27,956	W. H. Thorburn	Edinburgh Flying School	22.2.52
27,957	G. A. Robb	" "	22.2.52
27,958	H. Reenhough	Wolverhampton Aero Club	26.2.52
27,959	S. E. J. Dalton-Morris	Portsmouth Aero Club	26.2.52
27,960	F. Lacey	Qualified Service pilot	26.2.52
27,961	T. M. Yin	Air Service Training	26.2.52
27,962	J. N. Russell	Strathtay Aero Club	26.2.52
27,963	R. A. Lord	R.A.F. Oakington	26.2.52
27,964	J. H. Clerk	Marshalls Flying School	26.2.52
27,965	P. J. Cabourne	Qualified Service pilot	26.2.52
27,966	J. A. S. Crawford	R.A.F. Syerston	26.2.52
27,967	J. H. Shields	" "	26.2.52
27,968	D. Monsell	" "	26.2.52
27,969	E. R. Anson	" "	26.2.52
27,970	K. Hayes	" "	26.2.52
27,971	P. C. S. Rider	" "	26.2.52
27,972	A. M. Fletcher	R.A.F. Syerston	26.2.52
27,973	E. B. Sismore	Qualified Service pilot	26.2.52
27,974	A. Lewis	Swansea Flying Club	26.2.52
27,975	K. C. Smale	R.A.F. Cottesmore	29.2.52
27,976	D. K. Glover	Qualified Service pilot	29.2.52
27,977	R. J. Drummond	Strathtay Aero Club	29.2.52
27,978	J. F. M. Maybrey	Portsmouth Aero Club	29.2.52
27,979	R. V. Garland	" " "	29.2.52
27,980	D. J. Dermott	Plymouth Aero Club	29.2.52
27,981	D. H. Tod	Liverpool Flying Club	29.2.52
27,982	P. Sheardown	West Riding Aviation	29.2.52
27,983	C. Sowerby	" " "	29.2.52
27,984	N. H. Strange	Portsmouth Aero Club	4.3.52
27,985	J. R. Hart	Herefordshire Aero Club	4.3.52
27,986	R. S. Mills	Northants Aero Club	4.3.52
27,987	L. A. Jordan	Exeter Aero Club	10.3.52
27,988	M. Walsh	Shannon Aero Club	10.3.52
27,989	J. T. Gilbert	Plymouth Aero Club	10.3.52
27,990	G. W. Rippin	Herts and Essex Aero Club	10.3.52
27,991	F. McClory	Northants Aero Club	10.3.52
27,992	V. J. Nickson	R.A.F. Cottesmore	10.3.52
27,993	D. O. Rees	Northants Aero Club	10.3.52
27,994	R. Rimington	Qualified Service pilot	10.3.52
27,995	L. E. Clowes	" " "	10.3.52
27,996	H. G. Boyne	" " "	10.3.52
27,997	J. S. Chambers	R.A.F. Oakington	10.3.52
27,998	B. C. Long	" "	10.3.52
27,999	G. H. Smith	" "	10.3.52
28,000	G. G. Semark	" "	10.3.52
28,001	G. Thrower	" "	10.3.52
28,002	G. Roberts	" "	10.3.52
28,003	A. B. Simpson	" "	10.3.52
28,004	T. A. K. Wood	" "	10.3.52
28,005	F. Rothwell	Qualified Service pilot	10.3.52
28,006	J. M. Pashley	Midland Aero Club	13.3.52
28,007	M. Johnstone	Redhill Flying Club	13.3.52
28,008	G. A. Cornell	Cambridge Aero Club	13.3.52
28,009	H. R. Walbridge	Qualified Service pilot	13.3.52
29,010	R. F. Juggins	R.A.F. Cottesmore	13.3.52
28,011	S. Stevenson	Northants Aero Club	13.3.52
28,012	J. M. D. Sutton	Qualified Service Pilot	13.3.52
28,013	F. L. Maeus	Current P.P.L.	17.3.52
28,014	S. S. Kar	Hampshire Aeroplane Club	18.3.52
28,015	J. D. Barwell	Qualified Service pilot	18.3.52

ROUND ABOUT REARSBY: A section of the vast display of Auster variants present at the Auster-Ragosine Homing Trophy Contest on May 25th. In all, there were some eight different types of Auster. On the right is G. A. Farley, this year's winner, whose mount, Autocar G-AJYY, is the nearest aircraft of the three seen on the left of the general view. An account of the event appeared in "Flight" last week.



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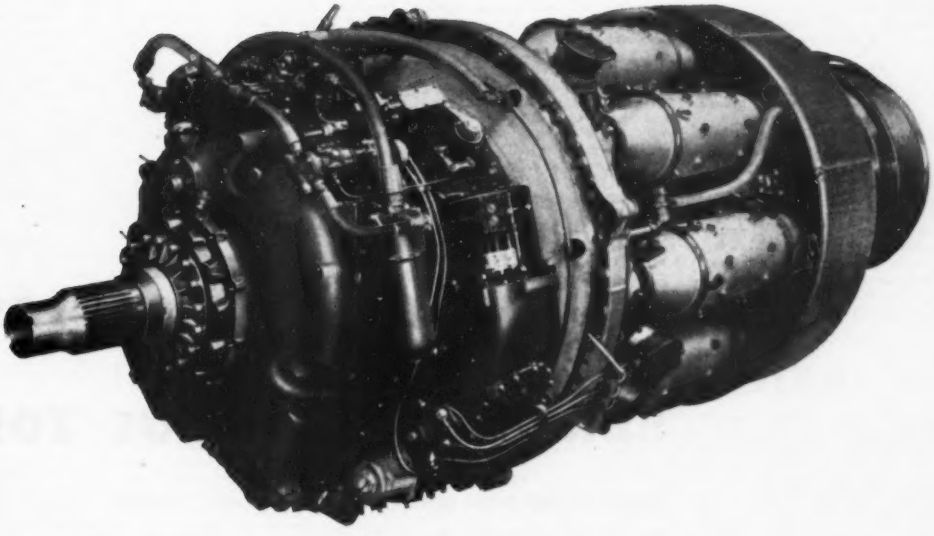

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YEADON DRAWS the CROWDS

A Hundred Thousand Watch the S.S.A.F.A. Whitsun Display

WHIT-MONDAY'S odd weather was comparatively kind to the 100,000-strong crowd that attended the air display at Yeadon, near Leeds. Sponsored by the *Yorkshire Evening News*, in aid of the Soldiers', Sailors' and Airmen's Families Association, a very enterprising show was prepared, but the high wind necessitated the cancellation of two or three of the events.

One of the highlights of the afternoon was the first public display, in this country, of an F-86 literally booming through the sonic barrier: a Canadian Sabre dived from 40,000ft to 20,000ft; and, when it pulled out, a very noticeable puff of condensation could be seen, followed a few seconds later by a loud explosion. After this dramatic introduction, the pilot, F/L. Kelley, put up a very polished display, which terminated in an amazingly slow fly-past, with everything down, at zero feet. Altogether a very good indication of the Sabre's possibilities.

The well-known French aerobatic pilot, M. Nicole, gave a beautifully varied show in a "rehashed" Bücker Jungmeister, made from a collection of pieces found all over the Continent, and now on the French civil register. The timing of his flick rolls was perfect and an innovation was the switching-on of a siren (mounted between the undercarriage legs) during the dives—very reminiscent of the Stuka during the war. M. Nicole's display was about the best of its kind seen since Prince Cantacuzene was in this country.

No doubt the act which most appealed to the crowd was the acrobatic stunt performed by Dragoljub Aleksic. This Yugoslavian "dare-devil" was due to perform on a ladder slung beneath a Po-2 but, unfortunately, the aircraft did not arrive in this country and a Tiger Moth was suitably modified for him. As this would have been the first appearance of a Soviet Po-2 in England, the sight of a "Tiger" was rather disappointing, but M. Aleksic's contribution was, nevertheless, clearly appreciated by his audience —particularly when he exhibited the strength of his dentures by hanging for about half a minute literally by his teeth at the bottom of the ladder.

(Above) F/L. Kelly brings his F-86 past the enclosure at about 115kt Note the extended dive-brakes. (Left) M. Fred Nicole's inverted fly-past in his rebuilt Bücker Jungmeister. "Flight" photographs

Neville Duke's demonstration in the Tomtit G-AFTA again proved what a master he is on any steed and at either end of the speed range, while two Royal Navy Sea Vampire 20s passed by on the best low-level beat-ups that have been seen for a long time. Variety ranged from another R.N. contribution in the form of a mock air/sea rescue by a Dragonfly to the perfect silence that prevailed during Gerard Smith's assortment of loops and rolls in a Slingsby Sky. It was a pity that only one of the three Canberras from Binbrook made an attempt to enter the aerodrome surrounds —a positioning fault also shared to some extent by the Meteor 8s of 609 Squadron, though their formation-keeping was first-class.

Another four F-86s of the U.S.A.F. displayed smoking orifices for a few minutes. By then the timing—started so well by Ranald Porteus in an Aiglet—had got rather out of hand, but the local population didn't seem to mind, as there was plenty of interest on show in the hangars, among it a number of tableaux depicting 30 years of Royal Air Force achievement.

ELMDON DEFIES the WEATHER

FARTHER south, in the Midlands, the weather was far less kind than at Yeadon. Determined not to be beaten, the Midland Aero Club managed to carry through most of the items of its display at Elmdon, though a succession of storms played havoc with the running-order. Birmingham had wended its way to the airport in force (there was a mile-and-a-half traffic jam outside), so it was the more unfortunate that the rain should begin at precisely the same moment as the opening event.

This opener was a "bombing" competition—a mistake, to our mind, at any display which seeks to entertain a big crowd, for flour-bag warfare of this kind is seldom spectacular at any time. On Monday, as the rain grew heavier, it was difficult even from the control-tower to see the bursts; at enclosure level it must have been impossible. However, the winner was Mr. Flack (Gemini, G-AJKS), with two bags bang on the target; Mr. Blumenthal (Hawk Major,G-ACYO) was second; and Mr. Hollander (Taylorcraft Plus D, G-AHVS) was third.

A delayed parachute-drop in rain must be singularly unpleasant, but "Chuck" Thompson of the Apex Group went through with his intention of stepping out of an Auster (flown by Capt. Stirk) at 4,000ft, with a smoke-candle tied to his leg to register his fall. Although the surface wind—which had been varying between 10 and 20 kt—had momentarily fallen light, so that he touched down with little drift, he had the bad luck to skid on the muddy turf and concuss himself sufficiently badly to earn a ride to hospital.

The weather grew steadily worse and, by the time F/L. R. J. A. Woods (C.F.I. of Birmingham University Air Squadron) took off in a Chipmunk for individual aerobatics, the ragged stratus was down to 1,500ft; nevertheless, he contrived to perform, and very nicely, most of the evolutions demanded by small boys whose requests were relaid to him over the R/T.

After some more delay, the ceiling grudgingly lifted again to 4,000ft, and allowed a C.F.S. Meteor 7 (F/L. Price) to come over from Honiley and aerobat brilliantly, compression-vapour flickering over its wings as it pulled out of dives; Price's eight-point roll was one of the most precise we have ever seen.

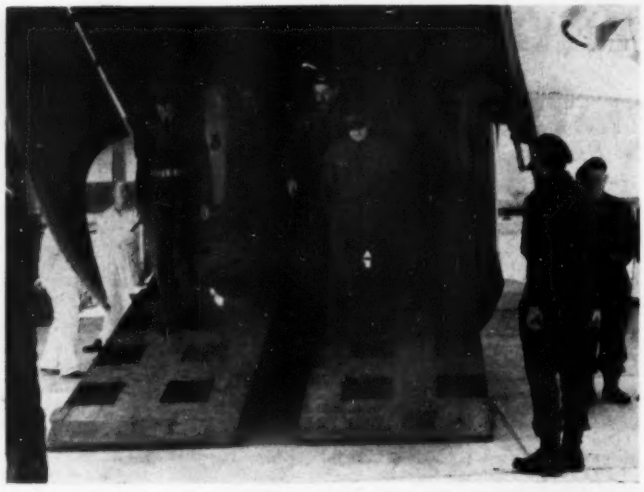
Then another storm piled out of the west but, cajoled by commentator W. Dono from the Coventry Flying Club, most of the crowd stayed put in the hope of a clearance. They were eventually rewarded by seeing Johnny Ralling walking a Tiger Moth's wings; a demonstration with a C.30a Autogiro, G-AHTZ —a *rara avis* these days—by Mr. Parkes; and air drill by four B.U.A.S. instructors in Chipmunks (F/L. Woods, F/L. C. M. P. Kempster, F/L. H. W. Thackeray and P/O. W. V. L. Rees). This last item gained by being performed at under 300ft—which, if it failed to show the "plan form" of the various formations to full advantage, at any rate gave an uncomfortably clear idea of the bumps, with which the quartet were having to contend. The airport crash-crew then put on a fire demonstration (would it not be better, we wonder, *not* to remind the public that aeroplanes occasionally catch fire, rather than to demonstrate that the fire can be put out quickly when they do? In other words, have the demonstration, but not with an "aircraft" as the bonfire).

Finally, the Meteor pilot, who had returned to Honiley, very sportingly came over again and ran through the second half of his extensive repertoire.

Altogether, a damp but valiant afternoon, on which the Midland Aero Club (and its C.F.I., W/C. L. H. Hunt, i/c organization) deserves mingled congratulation and commiseration. A word of praise, too, for the senior air-traffic control officer, Mr. D. N. Price, and his staff, who were not one whit dismayed by having to dovetail scheduled airline comings and goings with aerobatting Meteors, visiting Austers, joy-riding Rapides and messages about missing infants.

SERVICE AVIATION

Royal Air Force and Naval Aviation News



UP-TO-DATE LIMBER: The Chief of the Imperial General Staff, Field-Marshal Sir William Slim, accompanied by A. V-M. R. S. Blucke, of Transport Command, recently visited Abingdon to inspect the Blackburn and General Aircraft G.A.L. 60. The firm was represented by A. V-M. H. N. Thornton and Mr. N. E. Rowe. A gun tractor, complete with 25-pounder gun and trailer, was used for the demonstration. "Tim" Wood showed to advantage the Universal's ability to make short-run take-offs and landings. The C.I.G.S. is seen leaving the aircraft after inspection.

Queen's Birthday Fly-past

TO honour the Queen's birthday yesterday, a ceremonial formation of 18 Avro Shackletons from Coastal Command was due to fly over Buckingham Palace at 1 p.m. Her Majesty had announced her intention of watching the fly-past from the balcony.

Leaving St. Eval, Cornwall, at 10.30 a.m., the Shackletons were scheduled to arrive over Luton at 12 noon, Clacton at 12.20 p.m., and pass over Chelmsford at 12.50 p.m. The approach to London was *via* Fairlop, Wanstead and Stratford.

It was arranged that the Shackletons should fly in three groups of six, in line astern and with each group at an interval of 240 yards. An altitude of 1,000ft was specified. The commanding officer of No. 220 Squadron, S/L. A. E. W. Laband, was to fly in the lead.

On Tuesday of last week Londoners had an advance view of one of the Shackletons, which, at a fairly low altitude, made several dummy runs for timing purposes.

Ceremonial fly-pasts to honour the Sovereign's official birthday were carried out by Bomber Command in 1950 and by Fighter Command last year.

Women May Join O.U.A.S.

THE Oxford University Air Squadron has decided to admit women undergraduates to the unit, and has already accepted its first member. The girls will join the recently-formed Fighter Control Branch of the squadron to train for work in operations rooms. They will receive uniforms and, like the men, will spend two evenings a week training, and attend the annual summer camp for two weeks.

When they leave the University they can either join the Regular W.R.A.F. or continue in the Reserve. Although they do not receive flying training, they have the opportunity to fly with the instructors and experienced pilots of the air squadron.

Cambridge University Air Squadron does not admit women undergraduates.

The Queen Retains Her Squadrons

A MESSAGE from Buckingham Palace announces the intention of Her Majesty the Queen to retain her appointment as Honorary Air Commodore of the three City of Edinburgh units of the R.Aux.A.F. These are No. 603 Squadron, No. 2603 Squadron, R.Aux.A.F. Regiment, and No. 3603 Fighter Control Unit. The Queen, as Princess Elizabeth, assumed command of these units in June last year.

"G" Class Call-up

ON Saturday last two R.A.F. reception centres — Cardington, Bedfordshire, and Bowlee, near Manchester—received the first of the 5,000 "G" class and R.A.F. officer reservists to be called up for 15 days' training this summer. According to rank, reservists will receive pay for the period and a tax-free bounty of £4.

Conditions and procedure for the call-up are similar to those obtaining last year. Warning notices posted last January gave reservists a choice of eight training periods between May 31st and September 20th.

A.T.C. Win Shoot

IN a "postal" shoot, under N.R.A. direction, the Air Training Corps have beaten both the Sea Cadet Force and the Army Cadet Force. The scores for this event—the Inter-Service Cadet Small-bore match—were: A.T.C., 7,477 points; Sea Cadets, 7,438; Army Cadets, 7,415.

The two top-scoring A.T.C. cadets, Sgt. J. Bishop and Cdt. H. Oliver, both came from No. 470 (Falkirk) Squadron.

"Ocean's" Record Day

BEATING the records of H.M.S. *Glory*, *Theseus*, *Triumph* and H.M.A.S. *Sydney*, aircraft from H.M.S. *Ocean* recently flew 123 sorties in one day against enemy-held positions in Korea. During this one day, for the expenditure of 72 bombs and 456 rockets, the *Ocean's* pilots destroyed three railway bridges, an oil-fuel dump, many coastal gun emplacements, 15 loaded ammunition vehicles and attacked numerous troop encampments and stores.

Ocean is commanded by Capt. C. L. G. Evans, D.S.O., D.S.C., R.N., who was a

MEDITERRANEAN CRUISE: Pilots of No. 1831 R.N.V.R. Squadron at Hal Far, Malta, after flying from their base at Stretton, Lancashire, for two weeks' summer training. This is the first R.N.V.R. squadron to go overseas for training. Left to right: Lt. H. G. Tanner, Lt. T. J. Hamer, Lt. C. A. Brockbank, Lt. W. A. Storey, Lt. F. Morrell, Lt.-Cdr. R. I. Gilchrist (Commanding Officer), Lt. A. G. P. Elliott, Lt. R. A Guiness, Lt-Cdr. A. V. Donaghy, Lt. H. Burman, Lt. K. H. Tickle, and Lt. J. P. Supple. The London squadron, No. 1832, is due to arrive in Malta tomorrow.

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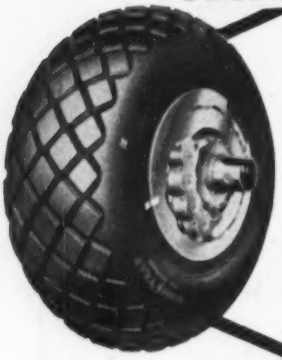
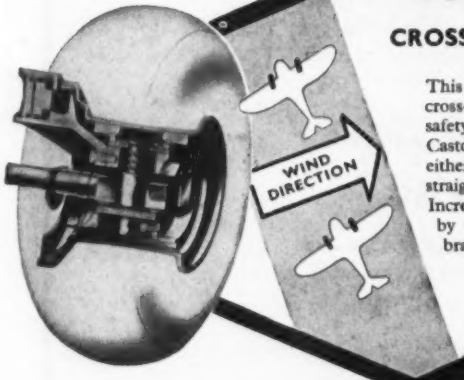


GOODYEAR
AIRCRAFT TYRES

Developed through years of research and testing, Goodyear aircraft tyres are built to "take it" on touchdown. Resistant to heat, fatigue and bruising, built to stand up to the impact of weight multiplied by m.p.h., they assure safety at today's high landing speeds. The All-Weather Tread illustrated is one of the variety of aircraft tyres, designed to give maximum reliability under all conditions.



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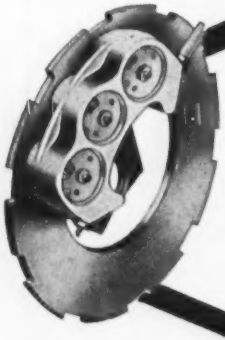
Increased flying safety is further enhanced by the incorporation of the popular disc brake in this revolutionary castoring wheel.



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The Disc Brake was first introduced by Goodyear several years ago. Since then the knowledge gained from actual operating experience has been vigorously applied, and to-day, the Goodyear Disc Brake has a reliability unique in this field. They give the pilot real confidence in landing, and sensitive control in every ground manoeuvre. Here again, Goodyear Research and Enterprise are far in the lead.

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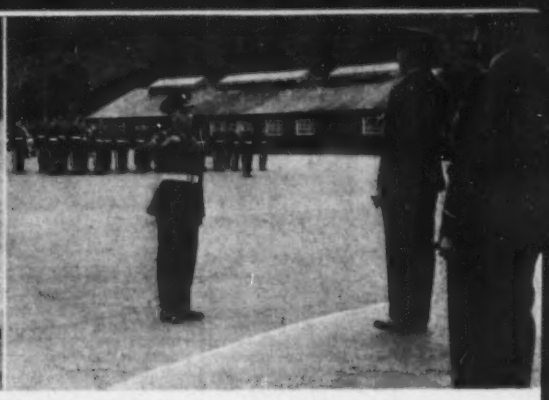


HALTON PRIZE-WINNERS: (Front row) F/S. App. C. A. Mackenzie, Air App. P. J. Midlane, Air App. G. T. Bedggood, Sgt. App. K. C. Brine and Sgt. App. I. G. Hilton. (Back row) Air App. A. W. Elsegood, Air App. K. J. Hobbs, L. App. P. M. Goodwin, Cpl. App. I. E. Sinclair-Day, Cpl. App. A. R. Conway, L. App. S. Hazzard and Cpl. App. G. R. Aspinall. On the right, F/S. App. Mackenzie, who was in charge of the parade, reports to the saluting base and asks Lord Tedder if he will inspect No. 62 Entry. "Flight" photograph

SERVICE AVIATION . . .

fighter pilot in the war. Her two squadrons are No. 802 (Sea Furies), commanded by Lt. Cdr. S. F. F. Shotton, D.S.C., R.N., and No. 825 (Fireflies), commanded by Cdr. C. K. Roberts, R.N.

No. 62 Entry Graduates

THE reviewing officer at the passing-out parade of the 62nd Entry of apprentices at Halton on May 27th was Marshal of the Royal Air Force Lord Tedder. With him on the dais were Air Marshal Sir John Whitworth Jones, A.O.C.-in-C. Technical Training Command; A.V-M. R. O. Jones, A.O.C. No. 24 Group; A. Cdre. J. G. W. Weston, Commanding R.A.F., Halton; G/C. D. O. Findlay, Senior Training Officer, Halton; and W/C. L. D. Dadswell, O.C. No. 1 Apprentice Wing.

There is no parade (writes a *Flight* representative who was present) quite like a Halton passing-out parade. In precision it is equal to the best the professional soldiers can show, and yet it is entirely in the hands of the apprentices—none of the staff is on parade. This last Entry, although small—a reflection of the poor recruiting figures in 1949—was well up to standard. Even Lewis Mk 1, who had been brought out from retirement owing to the indisposition of Lewis Mk 2, was quite up to standard and showed no sign of the irascibility usually associated with goats of his age.

In his report on the 62nd Entry, the Commandant, A. Cdre. Weston, said that it arrived in June, 1949 at a strength of 126 boys. During the three-year course no fewer than 66 left the Entry because of discharge, sickness, transfer to other schools or recoursing to later intakes. Twenty-six apprentices, however, had been re-coursed from other entries, and this made a total of 86. Of these, five failed.

Only two cadetships were awarded, F/S. App. C. A. Mackenzie receiving one in the General Duties branch, and Sgt. App. K. C. Brine the other in the Technical branch. Other prizewinners were: *Monsignor Beauchamp Memorial Prize* (best all-round apprentice), F/S. App. C. A. Mackenzie; *Crebbin-Robinson Cup* (best trades standard fitting test), Air App. P. J. Midlane; *Elliott Memorial Prize* (highest in English and general studies), Air App. G. T. Bedggood; *Air Ministry Prizes:* Highest in all subjects and highest in educational subjects, Sgt. App. K. C. Brine; highest in general service efficiency, Sgt. App. I. G. Hilton; highest average for practical fitting, Air App. P. J. Midlane.

The best tradesmen in the trade standards test were: *Airframe fitter*, Air App. A. W. Elsegood; *Armament fitter*, Air App. K. J. Hobbs; *Electrical fitter (air)*, L. App. P. M. Goodwin; *Electrical fitter (ground)*, Cpl. App. I. E. Sinclair-Day; *Engine fitter*, Cpl. App. A. R. Conway; *Instrument fitter (nav.)*, L. App. S. Hazzard; *Instrument fitter (gen.)*, Cpl. App. G. R. Aspinall.

Lord Tedder, in his address after distributing the prizes, referred to those who had passed-out that day as "survivors"—"a good thing," he added, "because the Royal Air Force must maintain its high standard." He also stressed the importance of team work, and to illustrate his point told the apprentices that in the North Atlantic Treaty Organization it was the airmen who were setting the pace for teamwork.

It is interesting to note that the school now has a number of apprentices under training from Commonwealth Air Forces. These include New Zealand, Southern Rhodesia, Pakistan, Ceylon and Burma. No distinction of any sort is made, neither is there any segregation of any kind and all prizes are awarded without regard to which Air Force sponsors the apprentice's attendance at Halton.

Halton Colour Presentation

FOR the presentation of the Queen's Colour to No. 1 School of Technical Training, which Her Majesty has signified her intention of making personally, it is intended to provide enclosures to enable a maximum number of ex-Halton apprentices to attend the ceremony.

However, owing to space limitations, it is necessary to restrict invitations to those apprentices who have successfully completed their whole course at Halton and who are still serving with the R.A.F., or who have done so and are now retired on completion of full service. Even with this restriction it is expected that a ballot will have to be held for the places available. For this reason, also, it is regretted that invitations cannot be extended to families.

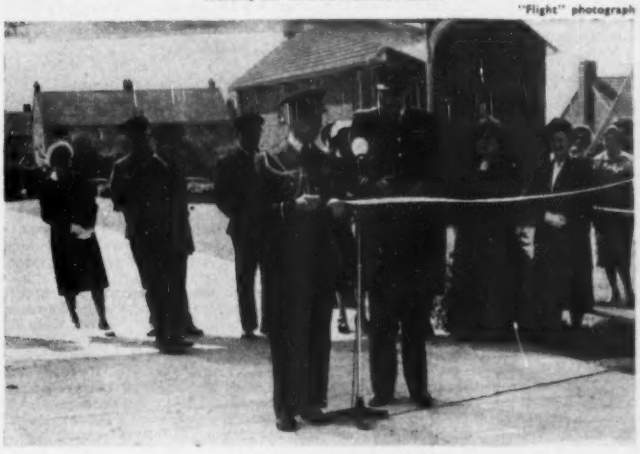
All eligible ex-apprentices who wish to receive an invitation should forward, not later than June 10th, the following details to the Personal Staff Officer to the Commandant, No. 1 School of Technical Training, R.A.F. Halton, Buckinghamshire: (*a*) Name, initials, Service number, rank and decorations; (*b*) entry number at Halton; (*c*) present unit; (*d*) address to which invitation should be sent.

Applicants who are unsuccessful in the ballot will be notified; others will receive an invitation, which will include full information on routeing, parking and other arrangements.

For those not included in the list of official guests, lunch will be available at a reasonable charge.

THE OPEN ROAD: While at Halton last week Lord Tedder opened "Tedder Road," a new road of married quarters for other ranks. With him at the tape-cutting ceremony is A. Cdre. J. G. W. Weston, the Commandant at Halton.

"Flight" photograph



CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

R.A.F.V.R. Equipment

A RECENT question in Parliament dealt with the absence of modern aircraft within the R.A.F.V.R., and whether the hundreds of soon-to-be-surplus Harvards could be put to better use by allotting several to each V.R. school as advanced trainers.

While this would be very welcome news for our V.R. pilots, it does seem more essential that those units still using vintage biplanes should be equipped with the discarded Prentices, which will soon be leaving the Service F.T.S.s. By employing the Prentice in this fashion, many hundreds of V.R. pilots will be spared the uncomfortable trips in open cockpits during the coming winter months. Although somewhat sluggish and underpowered in comparison to the well-liked Chipmunk, the Prentice does afford some measure of comfort, and is also a first-class instrument-flying trainer.

Give the week-end pilot something more than a "kite" and attendances during winter-time will equal those maintained in the fair-weather season. A typical instance of the need for more modern aircraft is given by a personal experience of the writer's. During a detail the taxying out to take-off point was easily achieved in spite of strong winds, due to excellent steering from pneumatically operated wheel-brakes. Prior to take-off the A.S.I. needle was fluctuating around 20 knots, ground speed zero—the aircraft a Prentice. No further comment needed!

Coventry. LEWIS G. COOPER.

[We do not believe that any surplus Harvards are likely to be available yet; the R.A.F. is still short of trainers in this category. In any case, there are not "hundreds" in service here.—ED.]

Beaulieu, Then and Now

THE ancient and beautiful village of Beaulieu is firmly enshrined in the pages of English history. On the banks of its river were built many ships of the Navy, fashioned from oak felled in the adjoining forest. And in 1910 it took its place in man's newest realm, the conquest of the air, for the New Forest Flying School commenced operations on the nearby commonland. The school came into being as a result of a meeting between W. F. MacArdle, a Bournemouth garage proprietor, and Armstrong Drexel, a rich American, who met in France where both were learning to fly at the Blériot School.

After practising on Blériot Type XI monoplanes at Mourmelon, MacArdle moved to Pau, where he was given French Certificate No. 72 after making a remarkable 24-mile flight. On this account he was awarded R.Ae.C. Certificate No. 47. Also at Pau was Armstrong Drexel, where he received instruction from no less a person than Claude Grahame-White. "Chips" Drexel was awarded an R.Ae.C. Certificate as a result of an observed flight at Beaulieu on May 31st, 1910. In view of the varied opinions expressed in the correspondence columns of this paper concerning the locality of this and the succeeding aerodromes, I have been to some trouble to verify the relevant facts. In regard to the N.F.F.S., what greater authority can there be than its manager, that doyen of the early flying days, Lt.-Col. Harry Delacombe?

This illustrious pioneer informs me that the School first used a smooth strip of ground perhaps 600 yd in length. On this pupils practised "rolling" (there was no dual in those days) and made short "hops". The straight was parallel to the road which runs from East Boldre to the fork of the Brockenhurst-Beaulieu road. In the apex of the fork is a mill dam, later known to the denizens of the R.F.C. as Hatchetts Pond. The adjacent ground was interspersed with brushwood and gorse, and the forest Verdurer refused permission for this to be cleared to form a flying ground. However, Lt.-Col. Delacombe induced Sir Evelyn Stafford-Howard, the Forestry Commissioner, to visit the school, as a result of which that dignitary granted permission. After the visit, Lt.-Col. Delacombe drove Sir Evelyn back to Brockenhurst in a milk-cart (the school Mercedes having broken down) during the course of which the Commissioner remarked that a fee would have to be charged for the use of the land. When the charge was specified at one guinea per annum there was no remonstrance! The first two pupils of the School were Capt. Barrington-Kennett (Grenadier Guards) who later became the first adjutant of the R.F.C. at Farnborough, and Maj. Cook (R.G.A.), who was destined to serve with the almost legendary Capt. Godfrey Paine, R.N., who formed the original C.F.S. at Upavon.

Now for the R.F.C. My friend Leslie Ash, who retired from test flying in 1946, learned to fly at Beaulieu on being commissioned to the R.F.C. in 1916. After having served in France with No. 70 Squadron, he returned to Beaulieu as an instructor, and shared the Fighter Flight with Pat Hammeraley. He informs me that the R.F.C. aerodrome was bordered on the east by the road which runs from East Boldre and round Beaulieu Rails to Lymington Harbour station, with the road from Hatchetts Pond to Lymington on the Western side. The present R.A.F. airfield is on the other side of the latter road, with the Beaulieu-Brockenhurst Road as its western boundary.

I submit that these particulars once and for all should define the juxtaposition of the three aerodromes, each of which has had its separate existence and portent.

Ryde, I.O.W. FRANCIS A. KAPPEY.

Salisbury Plain Memorials

YOUR issue of April 11th, containing an article referring to the early days of military aviation, reminds me of a flight I took seated on the shoulders of M. Jullerot (then chief instructor at the Bristol School) on a single-seater biplane, in 1913.

We made a rather uncertain course with flat turns around Stonehenge, Larkhill and Amesbury. Scattered about in this district may be seen several pathetic little stone memorials where those army-officer pioneers made their last landings.

Perhaps any reader who happens to be motoring in that district could spend an hour or two locating these memorials and recording the names before they are lost.

London, S.W.3. E. L. SMITH-MASTERS.

IN BRIEF

Mr. G. T. Wood, of 154 Manor Road, Mitcham, Surrey, would be glad to hear from readers who can spare post-war copies of *Flight*, which he requires for teaching recognition to Air Scouts; he is willing to pay postage.

TILTMAN LANGLEY DEVELOPMENTS

AT the recent annual general meeting of Tiltman Langley Laboratories, the research and development engineers of Redhill, Mr. A. Hessell Tiltman (chairman) reported steady progress, and the increase of the nominal capital to £30,000. The greater part of the company's activities had been devoted to re-armament work, but the general industrial demand for the firm's mechanical engineering research services was increasing.

Development work on the Tiltman Langley flow-valve was was going ahead and negotiations for a world licence were proceeding with an internationally famous valve-manufacturing company. The Gerritsen gear—an unorthodox form of infinitely variable transmission evolved by the company's chief engineer—also continued to be developed under Government contract and for various commercial uses.

Mr. Tiltman added that the company was accelerating a materials-testing programme designed to disclose the lesser-known strength properties; that the G.E.C. system of cold welding was also being developed for aircraft structures; that the company was interested in the development of small industrial and aircraft gas turbines and designs in this sphere had already been completed; and that the oil-combustion system designed for aircraft de-icing had been developed for agricultural and industrial drying.

Mr. C. H. Roberts had, under medical advice, resigned from the board and Mr. W. R. Tomkinson, F.C.A., had been appointed in his stead. Mr. G. D. Duguid, who was also vice-principal of the College of Aeronautical and Automobile Engineering, had also resigned from the board, owing to pressure of College work.

CONSULTANT ASSOCIATION

THE firm of Hedley S. Crabtree and Co. Ltd., consultant engineers (specializing in air transport, aircraft and engine-development and production consultation) announce the opening of a new West End office at 9, Ovington Gardens, London, S.W.3 (Kensington 9890).

The company has also entered into association with another well-known firm of consulting engineers, Peregrine and Partners.

Mr. E. P. Peregrine, B.Sc., A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., is recognized as one of Britain's leading mechanical engineers engaged on gas-turbine design and development, while one of his partners, Mr. A. K. Jeffrey, A.M.I.P.E., is equally well known in foundry work concerned with the production of aircraft components. Mr. W. A. Turner, M.I.M., the third partner of Peregrine and Partners, brings to the association a wide experience in the field of aluminium and magnesium casting techniques.

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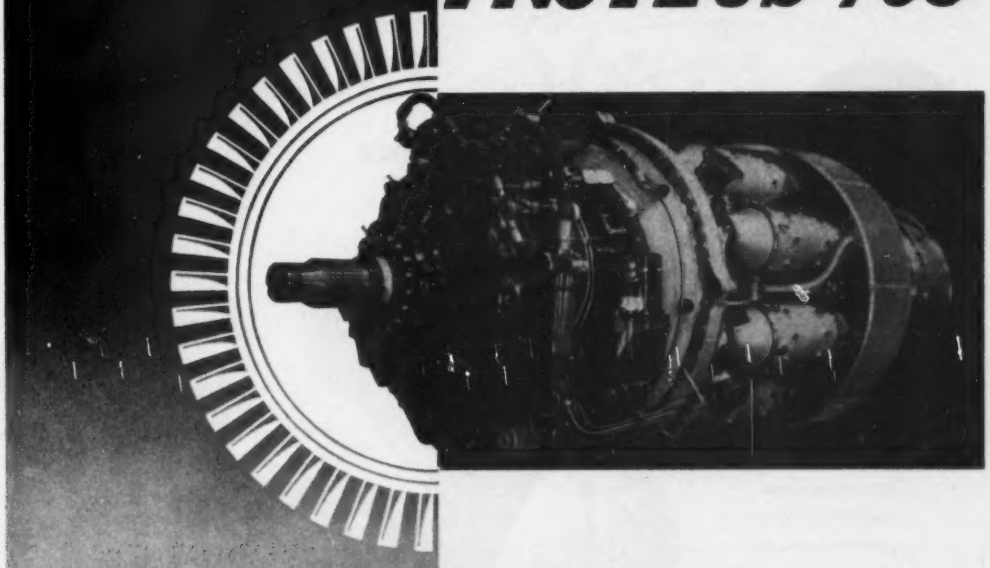

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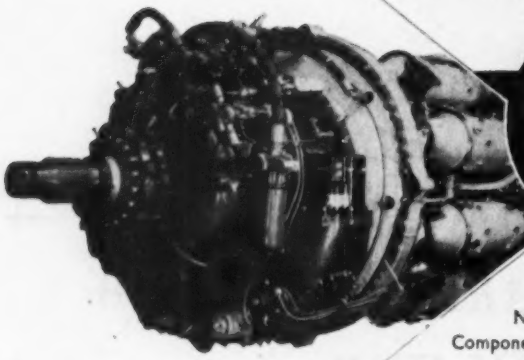

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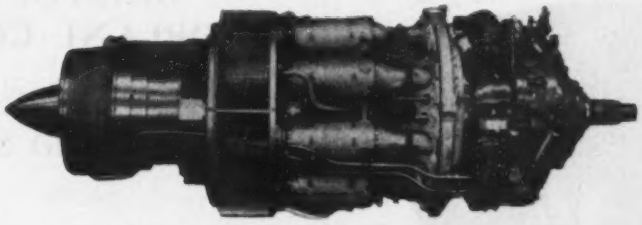

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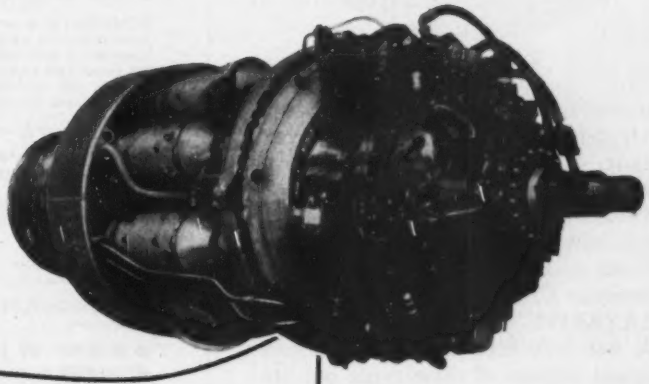

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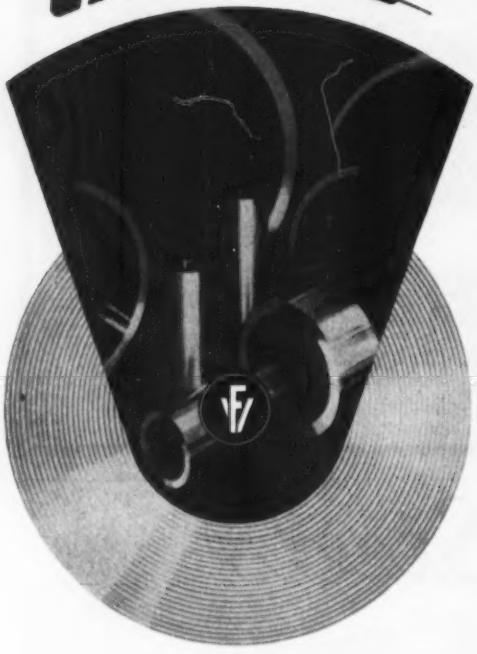

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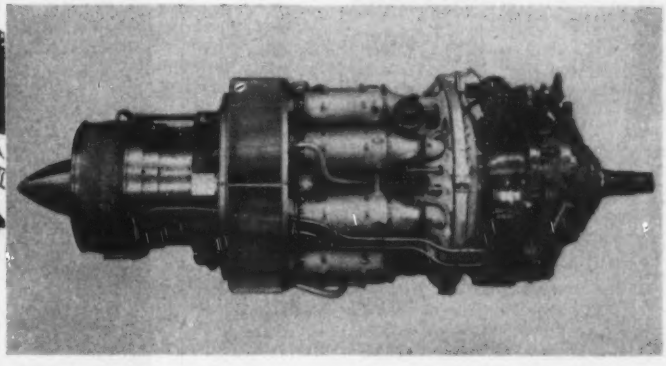

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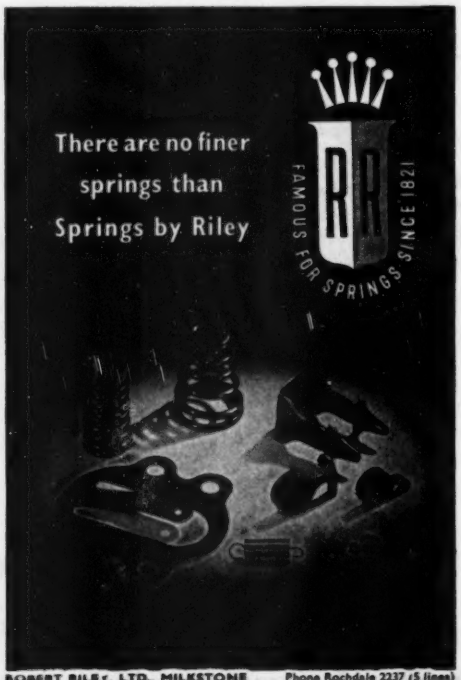

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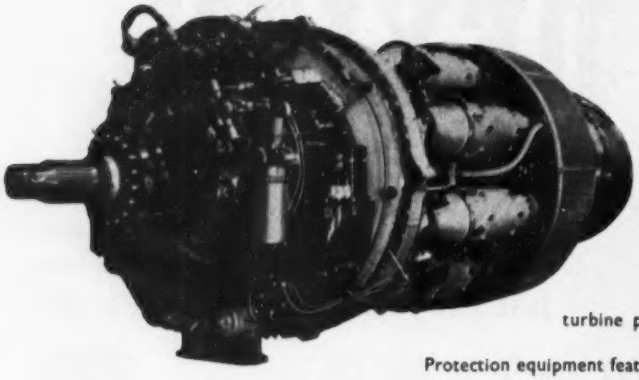

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SENIOR aircraft engineer required in South-east Scotland to take charge of flying unit consisting of multi- and single piston and jet Service aircraft. Experience of R.A.F. procedure essential. Preference given to licensed applicants.—Please write, quoting Ref. TD/S.AE, stating age and giving details of experience to the Personnel Officer, Ferranti, Ltd., Ferry Road, Edinburgh 5. (8127)

PLANNING engineer (aircraft) required by Percival Aircraft, Ltd., Luton Airport, Beds. Considerable practical experience of manufacture of metal airframe components and production planning essential qualifications.—Apply to Manager, Employment Exchange, Luton, giving full details of age, qualifications, experience and salary required. (0597)

AIR FORCE. Naval, civil and helicopter aircraft all under design and development at Percival Aircraft, Ltd., Luton Airport, Beds. Applications are invited from senior and junior draughtsmen, and stressmen for work on this interesting programme.—Write, giving details of experience and salary required, to Manager, Ministry of Labour and National Service, Luton, Beds. (0595)

APPLICATIONS are invited from senior and intermediate design draughtsmen. Experience of aero-engine design desirable, but not essential. Also checkers. —Please write, stating age and giving details of previous experience in chronological order to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. (0630)

DESIGN engineer required by the Aircraft Division of the English Electric Co., Ltd., for work on a supersonic wind tunnel at Warton, near Blackpool. Applicants should be of at least Higher National Certificate standard and experience of this type of work is desirable. Please write, giving full details and quoting Ref. 982C, to Central Personnel Services, English Electric Co., Ltd., 24/30, Gillingham Street, London, S.W.1. (0107)

CHIEF test engineer required by large firm, S.E. England, for Aeronautical Division, with good technical education to B.Sc. standard. Practical experience of production problems connected with radar, hydraulic servos and electronic servos in the aircraft industry. Progressive post, pension scheme.—Write fully stating age, experience to Box F.277, at 191, Gresham House, E.C.2. (8217)

APPLICATIONS are invited from design draughtsmen and stressmen, also technical assistants with combined design and performance experience for work on both reciprocating and gas turbine aero engines.—Applications should state full particulars of experience and qualifications and should be addressed to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. (0632)

BRITISH EUROPEAN AIRWAYS have a vacancy for a project engineer at Northolt. Applicants should have degrees or equivalent, in science or engineering and experience of engineering or airline operations. Experience in the aircraft performance and operational application of economics is desirable. Salary scale, £670 to £900 p.a.—Applications to Personnel Manager, B.E.A., Keyline House, Hanworth, Middlesex. (8207)

ROLLS-ROYCE, Ltd., Glasgow, require senior and junior technical assistants for work on technical production and quality engineering. Applicants should have engineering degree or equivalent with previous experience in a similar type of work. Salary will be in accordance with experience and qualifications. Prospects of advancement good.—Applications should be made in writing to the Personnel Manager, Rolls-Royce, Ltd., Hillington, Glasgow, S.W.2, giving full particulars of experience, qualifications, etc. (8152)

GAS aerodynamicist to lead a team of senior and junior aerodynamicists engaged on guided weapon work. Extensive knowledge of subsonic and supersonic dynamic stability and of practical and theoretical supersonic aerodynamics is necessary. Experience of aeroelasticity and of unsteady aerodynamics desirable. Pension scheme. Accommodation assistance may be given. British born applicants should send full details to the Assistant Manager (A), Research and Armament Development Division, The Fairey Aviation Co., Ltd., Dept. F, Heston Aerodrome, Hounslow, Middlesex. (8218)

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ASSISTANT production engineer, capable of checking designs for production of small intricate machined details and assemblies. Familiar with up-to-date machining practice and the use of fine limits and finishes. Experience of diesel injector work or similar would be an advantage. Age range 25-40, salary about £650, according to experience.—Write Personnel Manager, Dowty Equipment Ltd., Arle Court, Cheltenham, preferably in tabulated form, stating age and experience. [0149

MECHANICAL engineer with a flair for design from first principles is required by a large, old-established firm. A knowledge of aircraft instruments such as auto-pilots and navigational aids would be an advantage. He must be capable of building up and controlling a design team. Post carries good salary. A.M.I.Mech.E., H.N.C., or a degree in engineering preferred as a qualification.—Write fully, stating age, experience and salary expected, to Box F.272 at 191, Gresham House, E.C.2. [0203

BRITISH OVERSEAS AIRWAYS CORPORATION invite applications for the posts of link trainer instructors at Meadowbank, near London Airport. Successful applicants will carry out basic and applied training. Required qualifications include two years link instructional experience with sound knowledge of modern radio approach aids. Preference will be given to candidates who also have experience as a pilot and who hold R.A.F. link instructor category or equivalent. Salary range from £615 to £785 per annum. Applications, in writing, to Chief Personnel Officer, B.O.A.C. Airways House, Brentford, Middlesex. [0227

LONDON company invites applications for vacant posts involving technical sales liaison activity. Candidates should have sound practical experience, backed by technical and academic background to Degree standard. They should further be able to produce evidence of design capacity and personal accomplishment. On the commercial side they should have had sufficient experience to show that they can effectively combine their talents into a balanced technical sales approach. The work is essentially related to aircraft electrical equipment and accessories. Generous salary, car allowance and expenses will be paid to successful applicants.—Forward details of experience, age and education, quoting Reference L.66, to Box 0520. [0209

BRITISH OVERSEAS AIRWAYS CORPORATION require a stress officer for their design organisation based at London Airport. Applicants must be fully conversant with current Air Registration Board and U.S.A. design requirements; in possession of a recognised academic qualification; able to carry out complete stress analysis for major conversions and repairs involving primary structure and to complete the necessary reports to type record standard; in possession of a sound all round knowledge of modern aircraft structural design with a good practical background; in possession of at least three years' experience as an aircraft stress man and have been personally responsible for stress calculations of major components during the design of prototype aircraft, or for major modifications to series type aircraft; capable of making weight and balance calculations to the standard required for preparation of trim and loading instructions to meet the requirements of the Air Navigation Requirements. The salary range will be £780 to £1,000 per annum. Applications, in writing, should be addressed to the Chief Personnel Officer, B.O.A.C., Airways House, Great West Road, Brentford, Middlesex. [0226

MINISTRY OF SUPPLY require aeronautical engineer in the grade of experimental officer as a technical representative at one of the aircraft firms in England engaged on Ministry contracts. The duties include: (1) Investigation into defect reports on Service aircraft. (2) Application of new requirements to existing aircraft, including design, maintenance and operation. (3) Examination of installations, functioning and mechanical strength tests carried out by contractors, and examination of contractors' flight test reports. Age at least 26 years. The minimum qualification is Higher School Certificate with a science subject as principal subject, but possession of a degree, Higher National Certificate or equivalent qualification in aeronautical engineering may be an advantage. General aeronautical experience, preferably on design and development work, is desirable. Salary according to age, qualifications, location and experience within the inclusive range £397 to £788 p.a. (male). Rate for women, somewhat lower. The post is unestablished.—Application forms obtainable from Ministry of Labour and National Service, Technical and Scientific Register (K), Almack House, 26, King Street, S.W.1, quoting C324/52A. Closing date, June 27th, 1952. [0208

SITUATIONS WANTED

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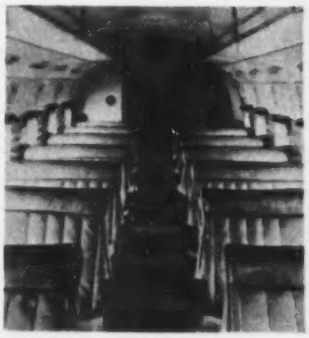

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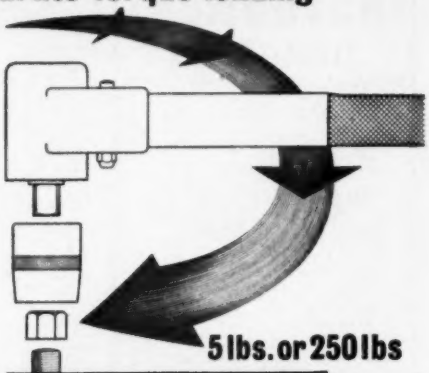

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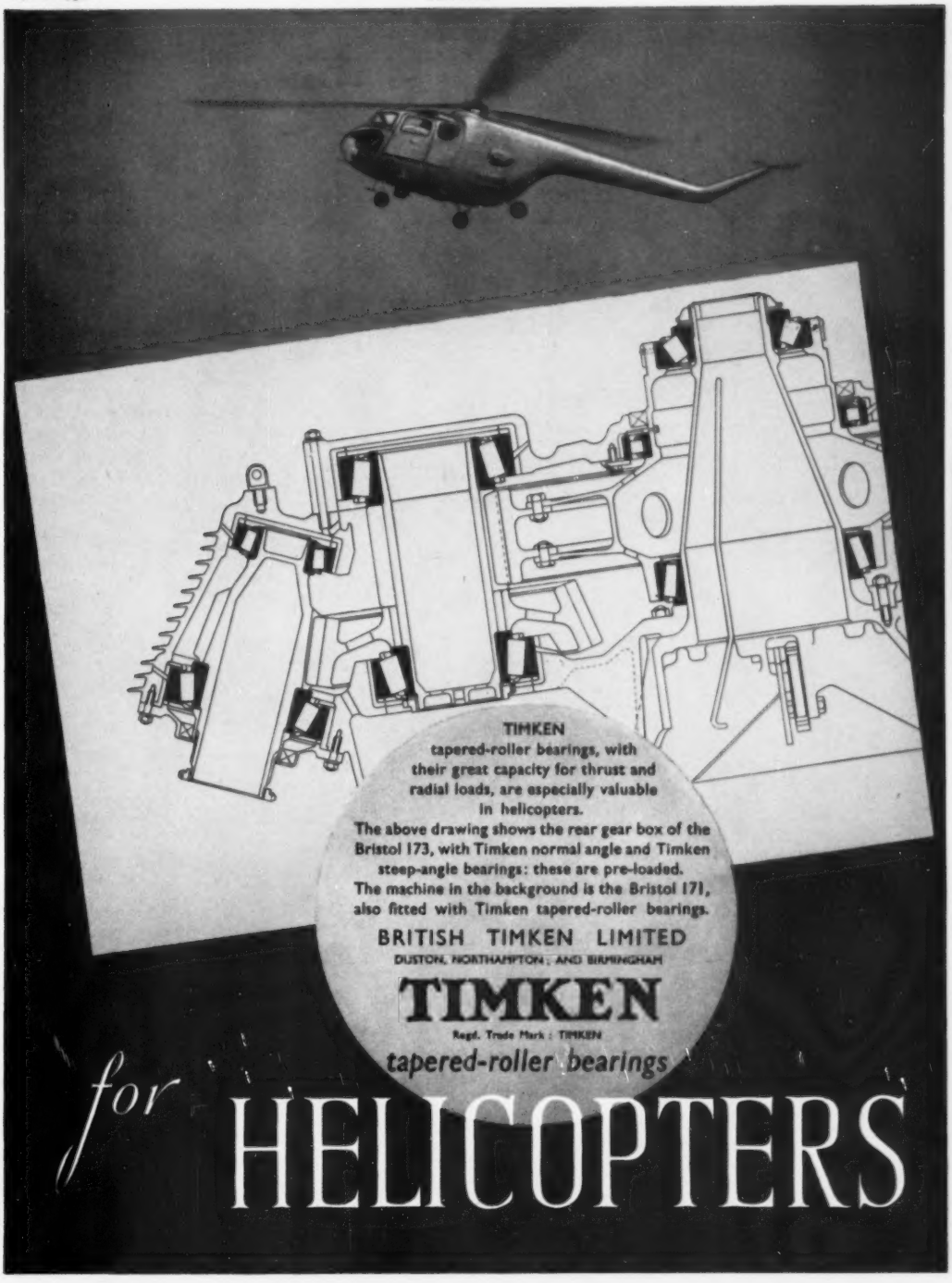

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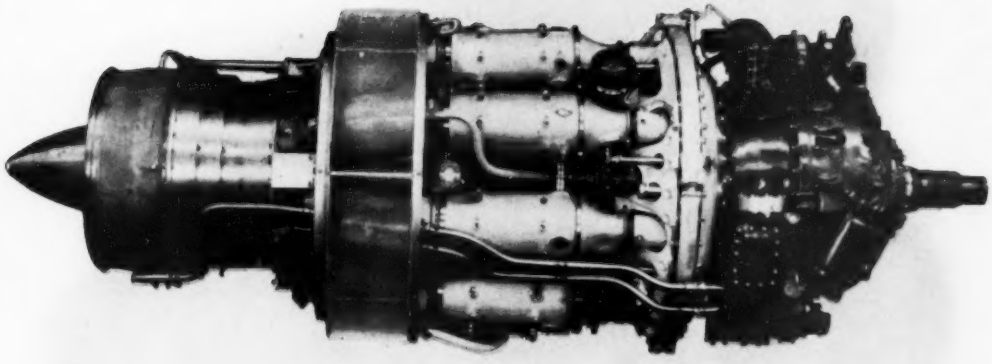

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